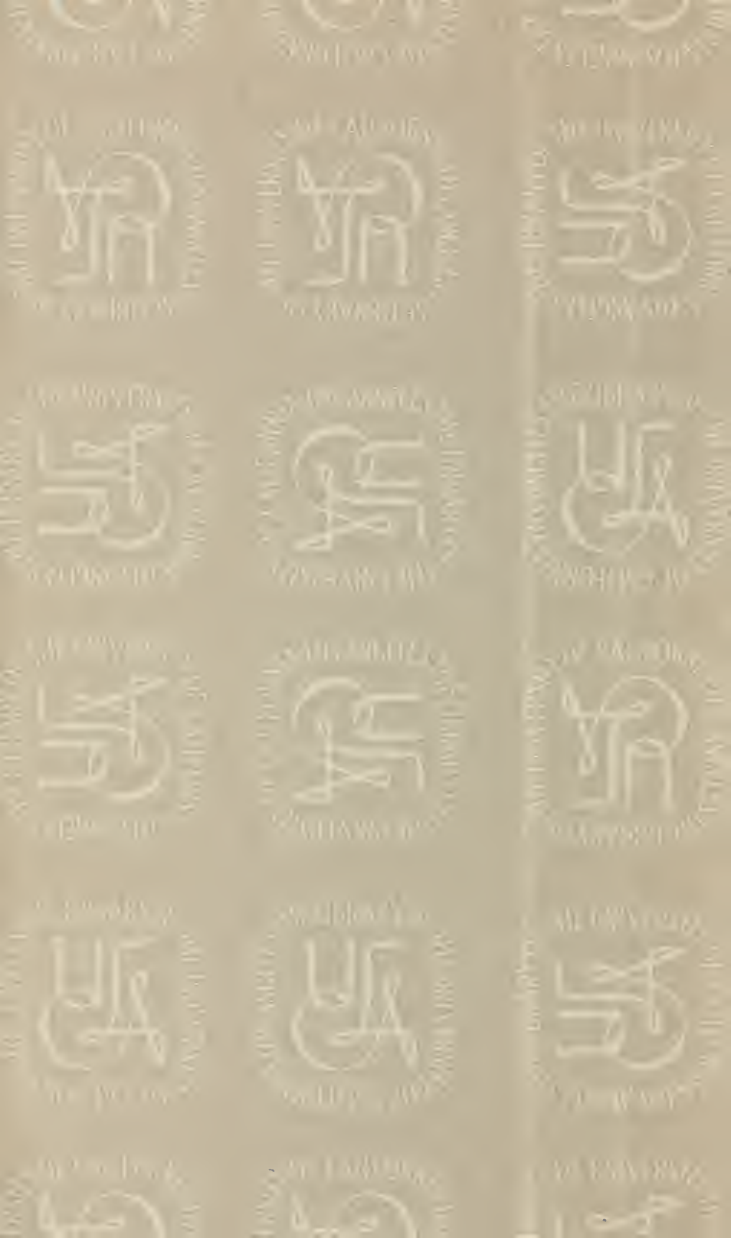

HOW TO LEARN EASILY

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PRACTICAL HINTS ON ECONOMICAL STUDY

BY

GEORGE VAN NESS DEARBORN

INSTRUCTOR IN PSYCHOLOGY AND EDUCATION IN THE SARGENT NORMAL SCHOOL, CAMBRIDGE; PSYCHOLOGIST AND PHYSIOLOGIST TO THE FORSYTH DENTAL INFIRMARY FOR CHILDREN, BOSTON; ETC.

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TO

F. W. N.

IMO PECTORE

PREFACE

WITHIN the last decade psychology has become, in a sense, the gauge of all the sciences and the most basal of them all. Psychology has taken the place long held in common by chemistry and physics, a change which was inevitable for the best of reasons — that by natural necessity the science of mind underlies our whole knowledge of matter. With all this significant and potent progress psychology unquestionably has neglected some of its inherent obligations to the twenty-five million American students (twenty-two million of whom are in school) who are expending precious time and energy and money in learning — some of them, to speak more accurately, in trying to learn. This vast multitude of our youths and maidens are making confident investment of their young years, the best they have or ever will have, in the wholly necessary means of future livelihood and anticipated happiness for themselves

and their hoped-for families. Academic psychology with its highly productive resources gladly owns to these the obligation of giving all it can to make this learning-process easier, more pleasant, and in all ways more productive.

The present handbook strives toward the attainment of this high utilitarian aim. For this not unworthy purpose it employs in part both the newer, important, concrete discoveries and wider points of view reached in the last few years of educational discussion, as well as the often more familiar pedagogic material derived in the slow ages of school-experience alone, now more and more discredited.

Because of the complete mutual interaction and integration of "mind" and "body" in the individual, practically everything in this book applies in some degree or other, — and when properly adapted, as accurately, — to motor learning, to the growth of bodily skill in all its phases, as to that learning popularly called "mental." To learn is to become able, and ability is always both organic and psychical.

The advice is written for the learner, but oftentimes the learner may best obtain it through the intelligent teacher — a responsible privilege some

teachers ignore. Those students will heed it most who realize to the effective degree that the saving principles of economics should underlie every rational endeavor, allowing neither time nor energy nor other of the riches of our precious, passing youth to be wasted. The one aim of the book, then, is to be of some immediate, practical use to those, young or old, who, in our workaday world, are engaged, whether vocationally or otherwise, in intensive learning.

In these days of highly organized play and recreation, often of an elaborate nature, it is worth noting that these principles and hints apply as well in this field as in that of education proper.

Part of the first chapter has been published already, and under its present title, in "The Medical Record", New York, and is reproduced here through the kindness of the editor, Dr. Thomas Lathrop Stedman. Part of the substance of the other chapters appeared as a serial in "The Scientific American Supplement" in the spring of 1916.

The author hereby expresses his cordial thanks to the scholars whose work and wisdom he has made use of, whether with or without explicit license.

I wish to express my appreciation to Messrs. Little, Brown, and Company for permission to reproduce extracts from my recent book, "The Influence of Joy"; to Messrs. D. Appleton and Company for permission to quote from Münsterberg's "Psychology, General and Applied", etc.; to Professor J. Carleton Bell, of the Brooklyn Training School, editor of "The Journal of Educational Psychology", for permitting me to quote a number of excerpts from that important periodical of educational science; and to the editors of "The Journal of Philosophy, Psychology, and Scientific Methods," and "The American Journal of Psychology," Professor F. J. E. Woodbridge and President G. Stanley Hall, respectively.

G. V. N. D.

Cambridge, Massachusetts,
May, 1916.

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HOW TO LEARN EASILY

CHAPTER I

ECONOMY IN STUDY

We must frankly face the fact that it is possible that some students in every class would be more useful to themselves and to the world in a "job", either on the front or back end of a street car; or in a good, substantial position in a machine shop, in a laundry, or in a confectionery store, or something like that. For it is possible, if not probable, that a certain percentage of a class are not at all of a scholarly "make-up", so that they can never be a success at any learned pursuit. The place to discover this is early in school, lest otherwise they waste precious time.

Interest in a Subject. — If students are naturally of a scholarly disposition it is much easier for them to study effectively than otherwise it could be. But whether scholarly or not they must first have a real interest in that which they wish to study.

If they have grown up without the "natural scholarly interest", it is their duty to acquire it. But when a real *interest* has been really acquired, they will learn almost reflexly and without any great effort, because it will be a *pleasure* to them. So this matter is truly worth while. Furthermore, students must have a continually changing and a continually developing interest. In every case, if they wish to economize time and energy and to learn adequately, they will, as a preliminary, develop an interest in the subject they are studying.

Some, in fact millions, never go far enough or deep enough to develop an interest — never deep enough to realize how unimaginably marvellous is their world of matter and life and mind. This may be "fate" or it may be just laziness.

The best way to develop an interest in any subject is by *collateral reading.* We should read broadly on subjects allied more or less closely to what we are studying. When it is physiology, for example, we should read about related sciences — physics, psychology, and the enticing histology of the nervous system. There are all sorts of exceedingly interesting material to be obtained from the libraries, which is related to this particular subject, complex and fascinating in itself.

Another way to develop interest is by *thinking* for ourselves of those relations. A third method is to *associate with people* who already have an interest. Fortunate is the student who can have the advantage of association with masters of the subject in hand! Whatever be the means, we must have interest.

Whatever we have an interest in, we enjoy doing, and that is the reason why well-adapted work, in the long run, is the most certain, if not the greatest, of human delights. Many people think of work as a necessary something, disagreeable rather than agreeable, but, on the contrary, it is certainly one of life's most permanent and substantial satisfactions and delights. Work (more properly called drudgery) that is not adapted to the individual is undeniably unpleasant. Professors in our colleges and universities, for example, rarely grumble about their work, and this is not primarily because their work on the whole is pleasant, but more because it is well adapted to them; for otherwise they give it up. It is the vast body of men who do not as yet have work which is adapted to them, who do not like to work. All great, useful, and original work ordinarily is done under such conditions that the work is enjoyable,

there being always enough of interest about it to make it pleasurable. It is under these conditions, furthermore, and generally under these alone, that the largest amount of energy is expended. This basal relationship is expressed in the science of efficiency in the term "Sthen-euphoric Index", meaning the more or less direct ratio between the expenditure of *energy* in any action and its inherent *pleasantness*. "Enjoy your work and you will most likely expend a very large amount of energy in it." This is the practical corollary of this fundamental index of organic dynamics.

The writer has published recently [1] a chapter on "The Economics of Happiness", a pioneer discussion of this perhaps sometime important topic, and it is so germane to the task of suggesting the easiest modes of doing mental work that much of this discussion must be repeated here.

The scientific economics of joy and happiness remains to be developed. In other terms, joy has a valuation (even if not yet in figures) in Wall Street on the bulletins of the Stock Exchange; in the factory office; among the maids in your home; in the coal mine; aboard ship; in your own private accounts which you keep to satisfy the income-tax

[1] "The Influence of Joy." Little, Brown, and Company. Boston.

collector. Daily joy has money-value as well as soul value even in the manual trades. And soon some man (or, more likely, perhaps, some ingenious woman economist) will begin to reduce it to grades, to "standardize" it, and to find its mean financial value to all sorts and conditions of workers.

There is an inherent relationship as deep as is conceivable in our human personality between the experience of a satisfaction which merges into plain enjoyment and the activity, fusing into the capability, of the body. This relationship is "immanent", as the metaphysicians used to say, in our self-reliance, in our pride of life, extending through the gamut from mere baseless vanity upward to the substantial manhood or womanhood which is certain of its worth and of its powers. The keen and great thinker Spinoza, nearly three centuries ago, put this primal relationship into plain Latin in three successive propositions of his "Ethics" (Part III, Propositions LIII, LIV, and LV), translated by Elwes:

When the mind regards itself and its own power of activity, it feels pleasure: and that pleasure is greater in proportion to the distinctness wherewith it conceives itself and its own power of

activity. The mind endeavours to conceive only such things as assert its power of activity. When the mind contemplates its own weakness, it feels pain thereat.

This emphasizes one side: that we take delight in our capability and vice versa; the other side, that our powers increase with the agreeableness of the process, it has taken a busy scientific century to demonstrate. Let us turn now to its more practical meaning.

If one compares the larger workshops of to-day with those of a few decades ago, one sees at a glance how much has been done in like direction, but with week-day good health and productive hygiene as the guiding star rather than happiness. It need not be suggested that the two are close relatives, daughters both of the same sound and handsome couple, the Busy Normalities. But happiness may be furthered for her own sake, being quite worth while herself as well as a complement to her hygienic sister.

Workaday joy has economic status, because *happiness is strongly dynamogenic*, increasing the expenditure of energy in every kind of work. Joyous behavior is more vivacious; and a happy girl in a paper-box factory will probably make at

least five per cent more boxes in a day than the same girl, unhappy, can pile up. Moreover, the work done under the stimulus of joy is not only faster but better in every way, for it means an attentive interest in the adjustments, making them more exact.

However considerable the efficiency increase in manual vocations, in those that are commonly termed mental (as if all such were not also neuro-muscular as well!) the productive advantage is far greater still. Here speed becomes usually of minor account, the quality being of importance out of proportion to the time required. And happiness urges its own perfection on what it helps create. The practical result of this two-phased principle of creative efficiency, and somewhat in ratio with the psychic freedom of the work, is that forms of art and philosophy and notably creative literature ordinarily are actually dependent more or less on it. The author, at a recent "Shop-talk" of the Boston Authors' Club, made a little more explicit some of this dependence under the title "The Author's Stheneuphoric Index." In part he said:

In its details this close association between happiness, or contentment akin thereto, and the

highest creative efficiency is a long and much involved story with complex plot within plot and incidents innumerable, whose scenario its Infinite Author is provokingly slow and hesitant to reveal (on this particular speck of the cosmos at least). My present years are in part employed in an attempt to understand this story whose practical meaning, however we view it, is so impressive. It is just one little phase of the master-knot of human mystery — the relations of the body and the mind, which in its last analysis reduces to the structure and the mode of action of the human nervous system, by all means the magnum opus of Evolution up to our era. The gist of the matter, the grist of this milling, appears to be that fatigue and pain and worry and impatience and real unpleasantness of every kind related to authorship and other creative work are abnormalities which actually diminish the speed and mar the quality of our entire creative efficiency. It is somewhat as if the course and the rate of a trolley car in our present wretched system were actually impaired by the wheels' squeak and the smell of the bad air and the personal repulsion and the jolt and the whole general impiety of the interior atmosphere. And sometimes in very sooth these are so impaired

— as from quarrels with the conductor or by withdrawals because of the bad conditions within. Fatigue and unpleasantness of every sort may find their sanctions in the world's last reckoning, for philosophy as well as for religion and theology. But so far as the definite practical economics of a workaday world is concerned, there is little doubt that for the most part organic happiness makes for greatly increased productiveness both in quality and in quantity.

Be not misled by probable personal memories of "forcing yourself to do excellent work when it was most unpleasant", etc., etc. Two ideas seem especially to belie this fallacy: (1) the inexcusable waste of nerve strength necessary to force the association of ideas along the paths which for efficiency should always be, so to say, downhill; (2) even more frequent, perhaps, a confusion of terms, the mistaking and misinterpretation of feelings due to ennui, and lassitude, for a real dysphoria or emotional unpleasantness underlying the action of the nervous system, in short, worry and true fatigue.

In general these last, the contrary of our more or less symbolic "joy," seem to be of practical economic importance in freely creative work. To

demonstrate this proposition, however, to set forth scientifically the details of this, the very heart of our matter, would take us into technicalities of physiology and psychology wholly out of place here. And you'll all be jolly well content, as our English cousins say, to avoid the stress and strain, and so merely be assured that such wholly undomesticated and unauthorized creatures as the cortical nerve-cell cytoplasm, internal secretions, blood pressure, and numerous like things underlie what we are slowly learning about this general relationship of unhappiness and unpleasantness to creative inefficiency or incapacity, objectively considered. On the other hand, your own interests it may be, as well as scientific theory, compel me to assure you that the practical fact seems to be substantially as I have said: It is better for your true "efficiency" that you should not do creative work at all at any given time than that you should do it when it is distinctly an unpleasant task, that is, whenever the high quality be the aim. This is true of all highly-skilled work, as Professor W. F. Book has shown. Where quality and progressive efficiency count, it is preëminently true of (new) creative work. But nowhere else certainly than in literary work are materials and methods and

results so wholly free, and therefore so wholly subject to the law. Mind and body are one, and language is an integral portion of the human mind, and of the human body which expresses and conditions it.

It is not only a matter, however, of actual capability, but also of wasteless capability. If we would reach our highest and greatest efficiency, do the best for ourselves in the long run and struggle, we must here as elsewhere consider "safety first." To push too hard against fatigue, continued disinclination, or positive unpleasantness, is to be wasteful of the best we have, or can have, as creators. And there's never any excuse for waste, anywhere, under any conditions, but, least of all, of a waste of our nerve force, of our vital energy, which goes apace but does not readily return.

The painters and sculptors and the musicians long have realized and practised this principle as a necessary condition of their best creative work. Let the painters teach you, then, their easily-learned lesson! those of you who have not already found this broad but (for once) straight road for yourselves.

When the different phases of creative work shall have been studied along this general method,

but with actual experimental data and mathematical results, then at length the economics of happiness will have been written in part. Herbert Spencer, Bain, Münsterberg, Grant Allen, H. R. Marshall, Max Meyer, Harvey, and numerous others already have taken this matter a little way along its physiologic road, far beyond Jeremy Bentham and the Utilitarianism of Mill. But in spite of these, which are, as it were, the steam engines and the electric motors of transportation, the true ultimate internal-combustion engine which will carry us along in contentment to the goal of hedonistic economics, although invented, is yet to be employed. Along this splendid roadway one speeds at will, and the ride, although a ride of joy, results for a certainty in no disaster.

Nearly every word of this brief account of the joy-efficiency ratio is applicable to the learning process. We learn fastest when we enjoy our study. We learn only at great extravagance of effort and of emotion when method or teacher or other conditions makes the subject and its mastery hateful or consistently annoying. How important in practice in the minds of thousands and thousands of our brightest grammar and high school children is this certain relationship! The

sthen-euphoric index certainly needs both theoretical discussion and practical application in its relation to all our schools.[1]

After having acquired a good interest and understood the relations between it, enjoyment, initiative, and energy, the learning process proper may be considered next. There are two kinds of learning as a procedure, one of which is a *conscious* process, conscious, deliberate study; while the second is another mode of learning, of which many are not even aware, namely, *subconscious* learning — by observation and association, more or less unconscious.

Conscious or Deliberate Study. — When we think of study, most of us consider only conscious, deliberate study, reading, or "grinding", usually in some book or other. This process is essentially a checking or restraining process, that which we call in physiology and in psychology "inhibition", an incentive of some sort to check some active process by a normal influence. The process of conscious study is one of an inhibitory nature — in its ultimate analysis the essence of humanity and of its civilization and culture.

[1] See also the writer's "The Sthenic Index in Education", *Pedagogical Seminary*, June, 1912.

In the first place we have to inhibit *fatigue* when we "grind." We are tired and would like to go to bed, or to go outside for a walk, or to some place of amusement that is restful. Theoretically there should be no fatigue. Work should be so arranged, alternating with rest and exercise and eating, that there should be no appreciable and depressing fatigue. This inhibition seeks a more *pleasant occupation.* Billy calls around to play "old maid" or something or other; or Cousin Susie wants us to go to the movies. Then there are many *distractions* which have to be inhibited; the reckless automobiles or carting on the avenue, cats on the back fence, a piano-torture from the next room, or someone beyond all humanity trying to play on the violin. All sorts of *sensory stimuli* have to be kept out of the effective mind. The *desire to change* must be inhibited, the perfectly normal tendency to change occupation and thus get rested.

Study, then, so far as deliberate, is the forcing of the mental processes along new pathways, the forcing of nerve-impulses through groups of perhaps thousands of neurones where they have not been exactly before. When interest is acquired and other things are right and we are in good

physiological condition, it is a real pleasure truly to grind. The habit of even this kind of study is easily acquired, much more easily in most of us than we think. The habit of inhibitory, forceful grinding on difficult study-subjects is soon acquired if we give ourselves a fair chance to acquire it; and knowledge and understanding will represent the comfort of our wives and children, for the two will be largely our earning capital.

We should beware of *false study*, dozing: trying to hold the eyes open while the brain is shut tight. In such cases the brain is not open, for the sensory paths and the association paths are closed. If we cannot force an interest or attention on what we are studying, we should rest entirely for a few minutes or else open the windows, stir about, and force the issue. Or, if conditions are such that we cannot possibly give our attention to the subject in hand, as may happen readily in fatigue, we should give it up. Unless we can give our whole attention to whatever we are studying, it is of little or no account to us, and much worse than that, it gets us into the bad habit of sitting with a book before us and pretending to ourselves that we are studying when, in reality, the brain-neurones are not getting hold of the facts at all.

The loss of a little time is of no account compared with the misfortune of this habit.

There should be *no rote-learning.* There are extremely few things that are properly learned by rote, and it is well to avoid attempting to learn in this way. In the long run it is a great waste. No lecturer or quiz-master who knows his pedagogical business will give out his material or opinions so that a student can take them down in the form of formulæ and "run it in" on an examination or elsewhere. A lecture should be, almost always, explanation and not description; lectures are properly complementary to texts. Facts and principles should be learned by concept, not by word.

There are certain *physiological requisites* for study, especially five things of a hygienic physiological nature which must be mentioned: (1) good health, (2) abundant outdoor muscular exercise, (3) abundant natural air, (4) abundant proper food, and (5) abundant sleep.

It is necessary for a student to have *good health,* else he is inexcusably wasteful. We cannot possibly study, for example, with eye-strain, for this inflicts a continuous strain on the brain and on the whole nervous system, which depresses

the vigor of the mental action. Students should not think of studying when they have a *headache*, for at such a time the brain is congested with blood. Under such circumstances it would be more economical to take a brisk, erect, longish walk out-of-doors, or to do almost anything except study. For a like reason, we should not try to study when we are *ill*, say with a bad cold in the head even, a mild influenza, or anything of that sort. Some try to study when they are at home "sick", which is absurd, unless it is a broken leg or something of that non-neural nature. It is very necessary that a successful student should be *free from worry*.[1] We should not stay a student and allow ourselves to worry about the family skeleton, illness in the home, or other things, even though they be of such real importance. If worrying interferes with the business of studying, we should either give up worrying or postpone the business, for certainly we cannot do both at the same time. In some cases, study can be made to force the worry out of the head; if so, it is well.

We should take *abundant gross muscular exercise*.

[1] See, for the therapeutics of worry and nerve-waste in general, a monograph called "Nerve-Waste", Health Education League Booklet, No. 27, Boston, second edition, 1914.

The reason for this is that exercise stimulates the circulation, and "keeps the cobwebs out of the brain", the spinal cord, and other important nerve-masses. Muscles, as well as brains, are used in thinking, and they don't work so well when they are flabby and out of tone, and poorly supplied with oxygen and clogged with carbon dioxide. Too much exercise, on the other hand, must be avoided, since it employs the brain and so tires it beyond use for study.

Abundant natural outdoor Air. — It is not necessary to study out-of-doors, as we can have plenty of outdoor air indoors by the simple expedient of opening the windows. Air of the proper temperature and proper humidity is essential. Moving air, properly moist and properly *cool* (68° F.), is the ideal.[1]

We should have *abundant food*, but not too much. The ideal is food that is easily digestible and taken often. Four moderate meals a day taken regularly, is far better for a student than two overlarge. Coffee may be taken if necessary for successful study. There are many authors who do

[1] For a discussion of the need of moving air and of other hygienic conditions, see the writer's "Certain Further Factors in the Physiology of Euphoria", *Psychological Review*, May, 1914.

good and abundant creative work under the influence of tea or of coffee, essentially alike in their stimulant action. Alcohol is a poisonous depressant and not a stimulant at all, save indirectly on the heart.

Students, to be efficient, must have *abundant sleep.* Ten hours is little too much. There must be no study within an hour, at least, after eating. On the other hand, gentle ambulatory exercise helps digestion. It is certain that if the blood is doing its work in the stomach, enough of it cannot be at the same time in the brain, and the brain cannot work without its normal abundance of blood. So that it is quite absurd to think of studying to good advantage immediately after a hearty meal. It is considered by many a good thing to take cat-naps at times through the day. Food digests best of all when we are asleep. We should not try to carry on our work on the boa-constrictor plan of taking one big meal every half-year and then going to sleep for the next six months! The boa-constrictor is a really poor student. Ten hours sleep is none too much, and cat-naps certainly are excellent, for a short nap, even of five or ten minutes, gives a large amount of cerebral rest; for even a five-minute

nap takes the blood for a moment out of the brain, stirs up things there generally, and makes us ready for a good siege of study. Professor William James and, more recently, Professor C. E. Seashore, of the University of Iowa, have called attention to the real importance of this matter, corroborated, as it is, by well-known principles of elementary physiology and by the psychology of efficiency.

Professor James, in his extremely important "Talks to Teachers," writes as follows: —

"We have lately had a number of accomplished Hindoo visitors at Cambridge, who talk freely of life and philosophy. More than one of them has confided to me that the sight of our faces, all contracted as they are with the habitual American over-intensity and anxiety of expression, and our ungraceful and distorted attitudes, in sitting, made on him a very painful impression. 'I do not see', said one, 'how it is possible for you to live as you do without a single minute in your day deliberately given to tranquillity and meditation. It is an invaluable part of our Hindoo life to retire for at least half an hour daily into silence, to relax our muscles, govern our breathing, and meditate on eternal things. Every Hindoo child is trained to this from a very early age.' The good fruits of such discipline were obvious in the physical repose, and lack of tension, and the wonderful smoothness and calmness of facial expression, and imperturbability of manner in these Orientals. I felt

that my countrymen were depriving themselves of an essential grace of character. How many American children ever hear it said by parent or teacher that they should moderate their piercing voices, that they should relax their unused muscles, and, as far as possible, when sitting, sit quite still? Not one in a thousand, not one in five thousand. Yet from this reflex influence on the inner mental states, this early over-tension, over-motion, and over-expression are working us grievous national harm."

Professor Seashore adds to this highly significant advice a suggestion which makes our point of view on the matter still more nearly complete. He says:—

"The feature which concerns us (in regard to the midday nap) is that the greatest benefit from normal sleep, night or day, comes from the very first part of it. From this we may derive a principle of mental economy. Cut short the long, light sleep of the late morning hours and substitute a short sleep at some favorable time during the work-day. Fifteen minutes of sleep after the heaviest work and the main meal of the day will count more for efficiency than five times fifteen minutes of sleep in the morning. The curve of day-sleep has the same form as the curve of night-sleep; but it is usually very much smaller. From ten to twenty minutes would cover the period of deepest sleep in the day rest of a normal brain-worker."

Attention to a book should *not* be *too long concentrated*, without pause. It should by habit be

concentrated vigorously, but only for relatively short periods at a time. The most useful periods of work when the mental effort is expended in associating numbers with letters (simple, for the purposes of the laboratory) have been studied by Professor Daniel Starch, of the University of Wisconsin. He says that in this work "it is more economical, within limits, to shorten the periods of work and to distribute them correspondingly over a given period of time. The most favorable length of period for this work seemed to be *between ten and twenty minutes.*" It is well, if we are to rely implicitly on opinions as rules of behavior, to have in evidence the figures of actual experimentation.

There should be more power of concentration for short periods than most schools inculcate, but we cannot keep the mind strongly concentrated for long periods under ordinary degrees of educational interest. Every twenty minutes or so a student should walk around the room for a minute or two, for this activity draws some of the blood out of the brain into the legs; moreover, it relieves the injurious long-fixation of the eyes. No one can sit for an hour, or an hour-and-a-half, without changing his position, except at a considerable loss

of nerve-economy. Under such a condition it is naturally difficult to avoid going to sleep, partial or complete.

Grammar schools and high schools almost never, as yet, succeed in teaching their students *how to think*, and still that is what counts most. A momentary, thoughtful idea often is worth a week of fruitless mechanical grind. Quality not quantity is what counts in study as well as in other things. When we study we should make a serious business of it, remembering that real learning, that is understanding and constructive power, comes only through thought.

Subsconscious Learning. — This is a mode of learning which one unfamiliar with psychology is not apt to think of as "study" at all. We acquire this kind of learning (both as process and as product) with the subconscious minds, physiologically chiefly, namely by the association of millions of neurones. Subconscious observation by subconscious minds would be a common way to characterize it.

A good example of this kind of study or learning is a child about two years old learning to speak. The child, at first, does not consciously strive to pick up the marvellous art of speaking, but none

the less he acquires it quickly, in part by imitation. We cannot understand anything worth learning without this factor of mind, the subsconscious mind, the great integrator of intelligence. The endless details of knowledge are supplied very largely by this unconscious mental process, this continual subconscious perception and observation by all the senses at once.

It is beyond our present purpose to describe this phase of the human mind, that deep and on-rushing part of "the stream of consciousness", which is closest to the nervous integrators of protoplasmic function. It is the great planner of our behavior, however, the chief solver of our most important problems in the conduct of life; it is the seat of our motives, the developer of our habits, the associator of our ideas into real and useful knowledge. I recommend it for study, that we may understand our own selves and the minds of those about us. Von Hartmann, Dubois, H. Poincaré, Morton Prince, Ribot, Coriat, Jelliffe, and Janet, teach about it, all that we need to know, until we learn to observe its phenomena first hand for ourselves.

At present we are concerned with the subconscious as the chief active recipient of information from the environment and as the chief arranger,

developer, and increaser of this ever-varying multitude of educational impressions. As has been said already, without the subsconscious there could be no real understanding of actual conditions of experience, so myriad are they and so complex and interinvolved.

We should keep all our senses open, therefore, to "light" of every kind imaginable, which the subconscious integrating process may relate to each other and to ourselves, and make us truly *wise*.

There are three chief ways of studying in this process of school and college learning. In the first place, by more or less conscious *seeing* and observing of books, diagrams, pictures, and other things that we can get only through our sense of vision. Second, *hearing* things such as lectures, recitations, and talk. And third, by actually actively *doing* things — extensive laboratory work, clinical work, and, to a less extent, essay-work, constructive drawing, research. To discuss these in detail here is out of the question, so that we must be content with the mere observation, although of basal and vast importance, that *doing*, as opposed to receiving, represents the modern method of learning even the most abstract of

subjects. The world is becoming aware, and effectively aware, that bodily efficiency one way or another is the basis of learning, or, in the words of wise old Pestalozzi, "*No learning without skill.*"

Imagination is essential in every scientific man who is more than a manikin. But *visualizing imagination* is of immediate necessity to every student. We must, for example, be able to look, in our minds, directly into any part of a living organism and accurately see just what there is and precisely what is going on there. The lack of this power, I am convinced, is the cause of the inefficiency of many engineers, geologists, physicians. Anatomy, for example, or physiology, pathology, surgery, clinical medicine are but impractical knowledge without this faculty, easily developed (by most students) by a little practice. I recommend it as an important accomplishment in itself, as well as a valuable means of study.

The taking of notes is of sufficient practical importance to warrant a brief discussion. If textbooks are the meat of the student, his notes are certainly his necessary drink, with his meals and at other times. It has been said that one "should train his powers of observation and memory" so as to be able to go into a lecture-room and remem-

ber the gist of the lecture without taking notes. But in the first place, we cannot develop our memory.[1] We should not attempt to accustom ourselves to listening to lectures without taking at least a few notes, unless the subject be untechnical. Every school lecture contains many material facts, and sometimes hundreds of them, and there is no mind that can remember them all, *economically*. No matter how vital and permanent they may seem the moment when we hear them, they probably are soon replaced with others equally interesting, and very soon most of them are gone, many of them for good, while part of those which remain are jumbled and mistaken.

We should take notes of everything worth noting. No matter where we are, whenever we hear anything, or even see anything worth noting, we should "make a note of it." These notes will be of value all our lives, the most vital links of our mind with our precious school-life; and often of great practical use, besides.

Notes should be arranged schematically in a psychologically scientific way, with center head-

[1] For a brief account of memory see the author's article in the *Reference Handbook of the Medical Sciences*, third edition, 1916, volume six.

ings, side headings, group headings, and sub-group headings, and put down according to *ideas* under such headings. When all run together, notes are not of much use. Let a book's elaborate analytical table of contents be a model for this. We should get into the habit of using abbreviations. Shorthand is desirable, economical, and almost necessary, but if we cannot manage to learn shorthand, we can acquire a system of abbreviation of our own device. Do not expect to get from a lecture anything that can be taken down and run in verbatim on an examination, for a good lecture is an explanation, not dictation; not a description; and not a set of crib-notes.

It is extremely important to economy that notes be kept "posted up" every day, if not in our notebooks, then in our brains. We should go over them in general every night and thus connect them with what has gone before, and so keep the mind up with the subject. *Examinations will take care of themselves* if we keep our didactic material posted up day after day. Examinations are not intended to trap us, but are intended as means to find out how much we know or do not know; mostly, in fact, how much we do *not* know. Cramming for an examination is like carrying

weights in our pockets when getting weighed: we are cheating ourselves. The economical way is to keep our notes posted up in our brains every day; so they can associate and we can learn much faster, giving our subconscious faculties a better chance. The power of grasping *ideas* is an extremely valuable one. We should pick out the gist and sense of a running discourse, select the ideas, and express them in our own words.

The drawing and writing of diagrams is of the greatest importance, and all put before us should be sketched quickly. The drawing of original diagrams is of much value, but the quick copying of those put before us is also very important. Things should not "go in one ear and out the other": there should be something within, between the ears, to fix the ideas, namely, the brains. One easy way to do that is by writing tersely the ideas, and drawing the diagrams whenever possible. We should learn to visualize, to see and hear and feel things in our minds, and this selection of the essentials will help this important habit.

Frequent reviewing is of the greatest importance. It tends to integrate things, keeps subjects unified, and puts the whole subject before us at once. Without a wholeness nothing is of much account.

We should have *as large a variety of textbooks* on every subject we study as we can possibly afford, for, in that way, we get different points of view of the same topic, and fixation is more certain. Every ten dollars paid for good books while students, will be worth a hundred dollars to us later on. And no wise person sells his old text-books, for each one has associations with his mind which make it often far more valuable and convenient to him in later years than a new one could be.

Conversation and discussion among ourselves are extremely important as means to accurate and broad information. Talk things over. Collateral reading always lends interest, and makes us better talkers, which in itself is well worth while in any man or woman.

The need for economy in learning, economy in time and energy, has long been recognized as a pressing need of the utmost economic and social import. No one, perhaps, has better stated this aspect of the question than has President Suzzallo, of the University of Washington, in the Report of the National Council of Education on "Economy of Time in Education" (Bulletin 38, U. S. Bureau of Education). He writes: —

"*More efficient and economical methods must be used, if the general schools are to be relieved of overpressure.* The waste in our schools for general training has been apparent. It will become more irritating, once we attempt to shorten the period of education by two full years. It will be doubly vexatious when we dare to add the new aspects of human training that modern society requires. Perhaps just this additional pressure is necessary to make us urgent in the improvement of our educational methods. Then, perhaps, we shall recognize that a cultural education must be measured by standards of practicality, less obvious but just as certain, as those which obtain in preparation for bread-winning. Who that is not superficial can doubt the practicality of a good character as a business asset? Who will not recognize the worth of a common stock of moral ideals, when two classes in the community wage unfair war upon each other? It must be our business to try to analyze more accurately than we have ever done the spiritual practicality of our general schools. Only then can we weed out our false practices and our ineffective instruction. It will be difficult to do, but it can be done, if we will only study men in the setting of a real social world. From the standpoint of the philosophy of education, there are three clear ways by which we can decrease the overpressure in our schools:

"(1) We must rid ourselves once and for all of that fallacy which insinuates that education is to be completed for any person within a given set of schools. A broad view of life tells us it is experience which educates. We are made by the whole length and breadth of life. Other institutions than the school do mold the pupil's character; life beyond the school will continue to amend

it. The school simply occupies a strategic position in human life because it works upon a plastic infancy with tools that are of very superior power, if rightly applied. But the fact need not suggest that the school must complete any man's education. More than anything else teachers require the courage to leave things undone. To make that possible, the teacher must not be content to teach students all the facts they need to know finally. The school can not do it anyway. It should take the focus of its attention off facts and forms perfectly learned and habits and attitudes completely fixed, and divide its attention between (*a*) requiring a thorough acquisition of some fundamental things and (*b*) developing interests in the unmastered domains, along with the power to attack these fields when the grown man faces them in his adult life. The first economy in our education will come through a completely changed point of view as to the school's function. It will take the emphasis off subject matter as an end, making it a means, and lay the stress upon the development of the child's power to proceed alone. What does it matter that a child does not know everything, if the school will make him wish to do so and give him the power of independent thought and study? Six years of school life are merely six years of opportunity to grow in knowledge and power. Let the school do what it can in the allotted time, always remembering that the child must be equipped to go on without the teacher.

"An incalculable waste occurs in our schools because this principle is violated. Fearful that the course will not be covered, that some fact will be left out, we hurry, crowd, and coerce children till they have no further interest in books when school is done. We have

taught them many facts superficially, but we have shorn them of the power to educate themselves. Children who have been in the presence of good literature for years never seek it again, because the teacher has maltreated both the subject and the children with his pedantic insistence on details. They acquire no more facts when school is done, because they have not been taught to work in freedom, without the admonitions and compulsions of the teacher. We must aim to do more for human power, by striving to do less in the way of giving students information.

"(2) We must reconstruct the course of study so as to eliminate that which does not need to be known, or that which is of lesser importance and can be gained by the student after a while. No mere professional theory of discipline should be allowed to take precedence over real social need. The curricula of our schools must be made in the light of our social surveys of what men need in knowledge, habits, powers, skills, and values. And these surveys need to be made accurately. If the vocabulary taught in spelling contains 3000 words, these should be the 3000 words most frequently used in the social world, not some mere compilation made on the guess of textbook makers. If his mathematical computations are taught him, they should correspond in fact and method with current adult practice. The selection of a course of study is always primarily a sociological matter; and every activity, traditional or innovative, should be eliminated when no relatively important social sanction can be found for it. All truth is useful, but in a few school years all truth cannot be mastered; what is less important must be dropped if a more important element calls for its time.

"(3) We must increase the efficiency of our methods of instruction. We are still divided into cults, as to teaching processes. If we like the old, we stick to a traditional procedure; if we are temperamentally fond of the new, we welcome innovation. We do not know the relative efficiency of an old as opposed to a new method; of a method used in one locality as compared with another employed in other school systems. We must as a profession eliminate the less efficient modes of instruction (*a*) by subjecting all our classroom procedure to the test of a comparative experimental pedagogy and (*b*) by establishing some central bureau of pedagogical knowledge which will keep the professional world informed as to methods and their values.

"The waste in education will not be difficult once we have (1) attained a more natural view of the school's functions, (2) provided social surveys as a basis for constructing courses of study, and (3) established an experimental pedagogy for determining relative efficiency."

Education as well as being a theoretically precious and a thoroughly practical thing, is in fact also a good *financial* investment. Some one has suggested that the uneducated man earns about $1.50 per day, or $20,000 in forty years; a high-school graduate about $1000 a year, or $40,000 in forty years; a college-man earns on an average say about $3000 per year, or $120,000 in forty years, when an average amount of work is done.

The difference between the first and second is $20,000, but the difference between the second and the third, between the earnings of the high school and the college graduates, is *$80,000*. That is a whole fortune in itself. These statements point out practically and explicitly the material value of an education to those numerous people who for the most part measure all things in terms of dollars and cents, — certainly the most general measurement-unit which we possess.

Huxley's definition of a liberal education is as follows: —

"That man, I think, has had a liberal education who has been so trained in youth that his body is the ready servant of his will, and does with ease and pleasure all the work that, as a mechanism, it is capable of; whose intellect is a clear, cold logical engine, with all its parts of equal strength, and in smooth working order, ready, like a steam engine, to be turned to any kind of work and spin the gossamers as well as forge the anchors of the mind; whose mind is stored with a knowledge of the great and fundamental truths of Nature and of the laws of her operations; one who, no stunted ascetic, is full of life and fire, but whose passions are trained to come to a halt by a vigorous will, the servant of a tender conscience; who has learned to love all beauty, whether of Nature or of art, to hate all vileness, and to love others as himself. Such a one and no other has had a liberal education."

That is in my opinion at once the most scientific and the generally best definition of an education that was ever written, and therefore is worth repeating continually. I wish, however, to call attention to one statement here and to show how to some extent it is mistaken. Along in the first part this definition says "whose intellect is a clear, cold logical engine, with all its parts in smooth working order", etc. One of the leading physiological psychologists of the world in the very broad and untechnical sense, Huxley here undoubtedly expressed a hope rather than a statement of fact. The epidemic of sometimes unscientific mental and physical "testing" from which America, here and there, is now suffering, has served, among other ends, to emphasize anew that the mind cannot, and indeed should not, be what Huxley has suggested above. Very recently Morton Prince, one of the most eminent authorities on the subconscious aspects of mind, wrote in a remarkable essay on "The Psychology of the Kaiser":—

"Our conscious thoughts are much more determined by subconscious processes, of which we are unaware, than we realize. One great popular delusion is that our minds are more exact logical instruments than they really are, and we stand in awe of the minds of great men, thinking that because they are superior in certain

directions therefore they are superior in all other directions of their activities, where they claim superiority. Whereas, as a matter of fact, a man may be eminently superior in certain fields of mental activity and psychologically a perfect fool-thinker and fool-performer in other fields. Helmholtz said of the eye that it was such an imperfect optical instrument that if an instrument-maker should send him an optical instrument so badly made, he would refuse to accept it and return it forthwith. He might have said the same thing of the human mind. It is a very imperfect instrument of thought. All we can say is that it is the best we can get. The deeper insight we get into the mechanism of the human mind the poorer thing it appears as an instrument of precision."

It is only man's instinctive egotism, on the one hand, uncorrected by his relative ignorance, on the other, that has kept this, the obviously correct scientific attitude, from long since becoming common wisdom. One who knows he has to work with poor tools will see all the more occasion and necessity for all the information and hints he can obtain, and will see the need also for the exercise both of the greatest diligence and the greatest care in using the tools he has. It is well always to realize that the body and the mind (in its scientific sense) educationally speaking are tools, tools none too efficient, which have to be *trained* labori-

ously into high ability. The mind, then, is in general a capable instrument but not particularly so as an instrument of precision.

It is well worth while for every student to be *economical in the use of time*, to learn in the most economical manner that he can employ. That is my chief sanction for offering as really important certain hints on the more economical methods of study and of learning — and of becoming wise!

We do not need here to discuss at all the nature of education. But I do suggest that a familiar and short definition of the essence of human education is the *adequate reaction of personality to its environment.* The "reaction" in this definition is for our immediate practical purpose the important thing.

We must remember, however, that the learning-process is not a *material process.* A teacher cannot give us a knowledge of literature, of geometry, of physics, or of similar subjects, as he might readily convey the detailed directions for doing fine presswork, or for building a complete doll's house, or for the construction of a fancy chocolate cake. The two problems are distinctly different. The best that one can do in giving advice on such a matter as learning — so subtle and at times seem-

ingly so wholly abstract — is to state, as simply as possible, the chief effective conditions involved and then to trust implicitly in the natural reaction of the learner's mind on the information secured.

Indispensable, certainly, for learning worthy of its high reputation, is the *consistent, deeply seated will-to-learn*. One must firmly impress his motivation-force and set it in permanent action, fully determined to support it in every respect. From the first in normal children the desire to learn is strong and may be relied upon. Professor Hall-Quest of the University of Virginia expressed much in an address in Richmond in November, 1915 ("School and Society", March 11, 1916), especially in the following two paragraphs: —

"Any one who has observed children knows that they are bundles of question marks. They are also mimics by nature. Curiosity and imitation in various combinations and levels of development are the *sine qua non* of learning. The harmonious and concentrated exercise of the attention upon a difficult task may be called the will to learn. It is the coöperation of the entire personality of one's being upon a task. The child may be restless for many reasons, but it does possess the will to learn in proportion to its interest in the undertaking. The interests of the child, as we know, are closely related to the instincts. The problem of education is partly the selection of those methods of teaching that

stimulate instinctive interests to the discipline of habit formation. If a child, in all respects apparently normal, seems to lack interest in kindergarten and school work this condition is due to one of two causes; either the natural interest of the child has not been appealed to with sufficient "punch" or the child is physically ill. Normal children want to learn. The plasticity, the resilience of the nervous system is wholly in favor of new impressions. The capacity of the young child for work is marvellous. Between its physical and mental activities there is a close correlation providing adequate measures are employed to arouse and keep awake the mind. Otherwise one meets the all too common results obtained by the Simon-Binet tests, children physically normal but mentally several years behind the chronological age.

"The importance of all this for the kindergarten teacher is obvious. There is need of beginning very early to teach the child the rudiments of reading, writing and the simplest processes of number work. It is true, as Fiske writes, that the period of human infancy is much longer than that of other forms of animal life because the purpose is so much higher and the results so much more significant for the race. But this should not mean that the period should be unnecessarily prolonged by delaying the introduction of subjects within the range of the child's capacity. The argument usually presented is that it is unfair to the child to force its mind too early. The fact is, however, that it is more unfair to force the child's mind to remain inactive too long. In the reorganization of the school programs up and down it is within the range of conservative prediction to state that within the next decade

there will be a successful effort made beyond that now current, to introduce the child much earlier to subjects that are now delayed because the child is supposed to be mentally unable to grasp them as yet. It is fundamentally a matter of method, not mental responsiveness. Boris Sidis' son and others like him have been called precocious. The fact is that they are fascinatingly normal. By a careful study of the child's abilities in the kindergarten it will be possible to determine to what extent its range of education should be enlarged. It will be found that when properly attacked the problems of reading, writing, number work, and those astonishing feats of the imagination leading up to choice bits of thinking form a firm foundation for the gradual supplying of information and for the gradual unfolding of powers that even in these days of enlightenment many parents and teachers believe far beyond the capacity of a child of four or five."

This dynamic aspect of mind, the resistless impulse to do and thereby to "learn", especially in youth, is the very key-note of modern pedagogy — as it is, in sooth, of modern psychology. The practical problem for every student young or old is the manner of best taking advantage of and utilizing this tremendous inherent dynamic tendency.

The precise process cannot, indeed, be described mechanically, for this will-to-learn must do its own work, secure its own personal victories over ignorance and inadequacy. In other words, the

student, whatever in all the intricate world of knowledge be his subject, must have a real and lasting desire to learn. Often this alone is enough — the native ingenuity of the learner's intelligence supplies the rest automatically, as biography shows us it has so often done. But many people who can swim really well use bridges even over narrow streams.

Now some of my readers may expect too much from my discussions. Some may mistake advice for energy, a dietary for a full diet, or, even, (in the words of someone else) the guide-board for a rapid and easy intelligent limousine. Just as eternal vigilance is almost always the price of safety, so continual effort is the least cost of an education, of effective learning. That is why an education is worth something, and in many directions too. I wonder if that *relationship between this difficulty and the value* ever occurred to many who read these words. Ambition and energy, initiative, push, work and effort (but never drudgery) are required for learning, whether hard or easy, for although the study-process is a most pleasant kind of work, almost never drudgery, it requires effort, because it is an *active reaction. We have to do it ourselves.*

Learning, again, as we often hear, but none too often yet, is not the mere filling of a barrel with apples, but the slow growing up of both the barrel and the apples from the seedling trees. But we may note that out of the five or six million people in the United States who cannot read or write, some have never seen the "guide-board", and do not know even where or how they wish to go! These certainly would not wish to be whisked along blindly in a limousine; nor should we, for in this case it's the journey that counts, not the mere arrival. Education is a progress, not a town with numerous gravestones on every hand. With an ever and ever widening vista, further and further on into the mental depths of Reason and Reality, the Cosmos of spirit and of matter opens to the serious student and to the persistent thinker. And as he dies, be it a good old age or earlier, whatsoever has befallen him or his in an adventurous Life, he realizes that he has had THE VERY BEST THIS SPLENDID WORLD AFFORDS.

CHAPTER II

OBSERVATION AND THE TAKING OF NOTES

Our first more explicit discussion is on observation, (in the very broad and useful psychologic usage of the term) and then on the taking of notes. Most of our learning comes from this Cosmos, this "environment", — our surroundings, spiritual and material, finite and infinite. The relation between the Cosmos and our minds is dependent largely upon the process of *observation*, including the observing of our own minds. The term observation suggests an important element of learning; in fact, learning is unthinkable without it, especially perhaps in the natural sciences, of which there are now so many. Observation is obviously a form of note-taking; it is taking notes and writing them "on the tablets of the memory", on brain instead of on paper.

There are two kinds of observation. There is a primary knowledge of nature outdoors, and under somewhat artificial conditions in the laboratory;

and then a secondary or mediate process, observation of books and of other, *e.g.*, pictorial, descriptions of the original observations by others. Both of these forms of observation furnish material for note-taking.

Direct observation requires a habit of the continually sensitive and accurate use of the sense-organs; organs of movement-sensation, of hearing, of touch, smell, heat and cold, sometimes singly but sometimes, too, all at once.

Observation always should be explicit; in fact, unless it be explicit, it is not observation at all, but a form of "wool-gathering." In many cases it must be minutely explicit in order to be of any value. Further details often lend things a wholly new aspect, details which have not before been noticed, and thus lead sometimes to important discoveries. All of this process of observation involves a fine adjustment (by means of muscles and nerves and sometimes obvious glands) of the sense-organs. "Trifles make perfection but perfection is no trifle," and thus it is in this phase, the detailed phase, of observation.

On the other hand, *observation must be also a process of observing things in their entirety* and in their general relation to environment. We must

not always miss the ocean's grandeur for study, however scientific, of the waves upon the shore, any more than we ought to miss the beauty of a forest because of the crowded trees. There is chance for varied observation in street-cars and in trains! Travel supplies the material for much observation and also the stimulus to use this power. Observation exercises the mind, while the travel tones us up and rests our organism. In general terms, direct observation is incompatible with book-study because it almost inevitably distracts the interest therefrom. This is one of the difficulties of travel, as used to be the mode, in order to study; we forget to study, and this inconsistency is natural.

Another matter: *this habit of minute adjustment of the senses involves a disregarding of whatever is already familiar,* so that, in a way, for effective observation we have really to be familiar with whatever we suppose we are familiar with; which is to say we really have to mind our P's and Q's, for observation, as it develops, requires intelligence.

Interest is absolutely necessary. Observation depends on interest, and with interest the observation-process becomes "reflex" or automatic and therefore easy. A boy's interest in girls, for

example, and a girl's interest in the fashions are practical interests which uniformly, in normal boys and girls at least, lead to a process of observation, which thus goes on continually.

There is a great amount of labor required in observation. It is not a passive process, but on the other hand demands much effort, much bodily activity, the details of which are too technical for discussion in this sketch of the nature of observation. This process of sensory muscle-adaptation is called perception. A perception is an active reaction to some object around, and requires many fine muscular adjustments; indeed these are its physiologic essence.

Sense-training of the simplest sort is one of the most important of all the elements of education, but for the most part only the feeble-minded children have the advantages of it! But no one, scarcely, is too old or too normal to develop at least a greater efficiency in this the very basis of intelligence. The *elementary educational system is at fault to omit sense-training* whatever else it might have to omit to give it room! Natural, spontaneous sense-training comes from natural interests, but it is only a fraction of what it might become by being trained. Few people yet realize

how utterly different things and events appear to different observers even under precisely the same objective conditions. Professor J. McKeen Cattell, of Columbia University, years ago made some striking demonstrations of this difference. A two-colored quadrangular card was exposed for a short time to a dozen or two intelligent persons singly, and when the drawings of what each "subject" saw were compared it was found that only two perceived the square red-and-green area alike, and these not exactly so, despite the mere chance of perceiving similarly. To quote the researcher's own words as given in the Proceedings of the American Psychological Association, 1899:—

"When a moving surface is exhibited as it passes under a window in a screen it appears larger than the window. If green is exhibited first for $\frac{1}{20}$ second, followed by red for $\frac{1}{20}$ second, the observer does not see green followed by red, but the two colors are seen side by side, variously arranged and intermingled, filling a larger area than the window through which they are seen. A series of physical and physiological processes in time makes for perception a spatial continuum. In this case, however, the same physical stimulus gives rise to entirely different perceptions with different observers, indicating that the processes of visual perception are largely built up by the individual.

"When in the ordinary vision of daily life the line of

sight moves over objects, say the books on a shelf, each retinal element is successively stimulated, but the objects are seen simultaneously, side by side. In this case the intermittent stimulations may occur as rapidly as 1000 per second without any fusion or blurring. This fact indicates that fusion and, indeed, all the phenomena of color-vision, are cerebral rather than retinal.

"These experiments, demonstrating as they do that a time series is perceived as a space continuum when this is advantageous for our reactions, show anew that our perceptions are not 'copies' of a physical world or correlates of simple physiological processes, but are dependent on experience and utility."

Thus sense-perception, observation, in the young child is far more even than it appears to be, for it builds the very foundations of the mind. How long is our system of general education for normal children to accept, but idly, the obvious reproach that the mental defectives at the present time in some schools (for example that founded and developed by Seguin and now ably directed by Dr. Walter Elmore Fernald in Waverley, Massachusetts), that the feeble minded are given more careful sense-training than is to be had by other more successful children in the "grades"?

Dr. Charles W. Eliot, President Emeritus of Harvard University, at the Pan-American Scientific Congress in Washington, 1916, in the course of

a timely paper entitled "The Changes Needed in American Secondary Education" spoke the long-necessary words for sense-training and for motor-training — obviously only complementary phases of the one and the same process carried on by nerve-circuits, muscles, and glands — in short for perceiving and doing as the basis of all education worth the getting and having. For ten years the present writer has been attempting to work out the psychobiology of this very matter, *the sanction of the body and its life*, each of us in his own personal apotheosis ere he dies. But the sceptics (in the university trustee-boards no more than in the city slums) will not learn the story — yet! But Dr. Eliot says:

"It follows from these considerations that the training of the senses should always have been a prime object in human education, at every stage from primary to professional. That prime object it has never been, and is not to-day. The kind of education the modern world has inherited from ancient times was based chiefly on literature. Its principal materials, beside some elementary mathematics, were sacred and profane writings, both prose and poetry, including descriptive narration, history, philosophy, and religion; but accompanying this tradition of language and literature was another highly useful transmission from ancient times — the study of the fine arts, with the many kinds of

skill that are indispensable to artistic creation. Wherever in Europe the cultivation of the fine arts has survived in vigor, there the varied skill of the artist in music, painting, sculpture, and architecture has been a saving element in national education, although it affected strongly only a limited number of persons. The English nation was less influenced by artistic culture than the nations of the Continent. American secondary and higher education copied English models, and were also injuriously affected by the Puritan, Genevan, Scotch-Presbyterian, and Quaker disdain for the fine arts. As a result the programs of secondary schools in the United States allotted only an insignificant portion of school time to the cultivation of the senses through music and drawing; and, until lately, boys and girls in secondary schools did not have their attention directed to the fine arts by any outside or voluntary organizations. As a rule, the young men admitted to American colleges can neither draw nor sing; and they possess no other skill of eye, ear, or hand.

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"In recent years, on account of the complexities, urgencies, and numerous accidents of urban life, there has been a striking revelation of the untrustworthiness of human testimony, not because witnesses intended to deceive, but because they were unable to see, hear, or describe accurately what really happened in their presence. This inability to see, hear, and describe correctly is not at all confined to uneducated people. On the contrary, it is often found in men and women whose education has been prolonged and thorough, but never contained any significant element of sense

training. Many highly educated American ministers, lawyers, and teachers have never received any scientific training, have never used any instrument of precision, possess no manual skill whatever, and can not draw, sing, or play on a musical instrument. Their entire education has dwelt in the region of language, literature, philosophy, and history, with a brief excursion into the field of mathematics. Many an elderly professional man, looking back on his education and examining his own habits of thought and of expression, perceives that his senses were never trained to act with precision; that his habits of thought permit vagueness, obscurity, and inaccuracy, and that his spoken or written statement lacks that measured, cautious, candid, simple quality which the scientific spirit fosters and inculcates."[1]

Thus we have to learn to observe much as we have to learn to become skilful. Skill is the same process as accurate sense-perception; and voluntary attention is another psychophysical operation which involves perfect and general bodily control, and must be taken in a general and broad sense of bodily fitness. It includes at least five fundamental states and processes: (1) it involves vigor; (2) it involves a great deal of initiative; (3) it involves mental quickness (wit) and (4) sensitivity to every educating influence; and, (5) self-confidence is indispensable. Intelligence itself (which

[1] U. S. Bureau of Education Bulletin, 1916, No. 10, pp. 5 and 8.

is only a larger name for skill) is but a fine adaptation to and appreciation of one's effective environment, spiritual and material. Skill in its essence is a cursive general voluntary power finely to adjust the muscles, and those used in the adaptations of the sense organs in some cases, especially. Since there is no mental process without muscular innervation, skill is obviously closely allied to intellect, — even though the syllogism here employed be imperfect. More than a hundred years ago the famous Pestalozzi said, as already quoted: "No learning without skill", — a dictum for pedagogy so basal as to be worth repetition for the sake of emphasis. The whole relation of the mind and body is involved in an actual demonstration of this proposition; but it certainly can be accomplished. Skill is potential imagination of the practically constructive sort, and this we shall discuss, as a means to easy learning, in a later chapter.

Professor Münsterberg, of Harvard University, offers much timely wisdom in this matter in one of his recent books:

"We cannot emphasize too much the similarity between the external and the internal actions, between the movements of the limbs and the movements of the

thoughts. To remember, to invent, to attend, to observe, to reason, means above all to adjust inner impulses to the final aim, to suppress and inhibit those which interfere and to excite and reënforce those which lead forward. The training in external actions is practically the model process for the training in all psychical abilities. If we are to gather from the training in motor abilities the principles for the training in abilities in general, we ought to put emphasis on the following psychological factors. First, we must make use of the involuntary reflexes; secondly, we must make use of the instinct to imitation; thirdly, we must resolve the complex action to be learned into its elements; fourthly, we must reënforce the activity by suggestion; and lastly, we must mechanize the process by repetition.

"*The involuntary motor impulses* and reflexes are indeed the given material without which no development of voluntary powers can be understood. There are numberless short cuts and substitutions, but somehow all learning of an intentional activity starts from the experience of involuntary reactions which come up from the inborn psychophysical dispositions. In a corresponding way we have to accept the tendency to *imitation* as the inborn disposition which is not learned, but which precedes learning. No child could learn to speak who had not the instinctive impulse, first, to produce sounds, and secondly to imitate sounds. This imitation is at first imperfect, but it is just the incompleteness of the success which drives the child forward. The most essential further step is the *resolution of the action* into simpler motor functions, which slowly become combined. Whether the child learns reading

or writing, dancing or swimming, carpentry or piano-playing, the whole set of simultaneous and successive movements must be built up by imitating the single actions which in themselves are useless for the final purpose.

"A skilful training demands no less the suppression of opposing impulses, and this is the place where suggestion has its chief task. Finally, there is no learning of motor ability without *repetition:* every new performance decreases the resistance in the motor path until the response to the stimulus becomes automatic. The formation of such habits is the significant end. The trained piano player does not exert his will for the special finger movements. As soon as the idea of playing controls his motor setting, the black dots on the paper produce the immediate impulse to the right finger-actions. It is evident that the coöperation of these five psychophysical factors demands the most perfect adjustment, if the result is to be reached in the shortest time, with the smallest effort and with the most finished effect. The desirable alternation between periods of training and periods of rest, the rhythm and rapidity of repetition of one group of movements before a new set is learned, the most economic analysis of the complex, the various habits of manipulation and control, the associations formed between the sensory impressions and the actions and many other factors must determine the advance."

These each and all are contributions, or might be well so used, as to how to learn easily at any age.

Professor J. B. Watson, of Johns Hopkins

University, is at present engaged in elaborate research which will greatly extend the work of Bechterew in Petrograd and will show anew how easily made are many highly useful bodily associations through the extremely adaptive system of nerve-units. In a recent address before the American Psychological Association, he summarized the matter somewhat as follows, (in which "reflex" denotes the associate reaction in some cases): —

"As Bechterew's students affirm, we find that a simple way to produce the reflex is to give a sound-stimulus in conjunction with a strong electro-tactual stimulus. Bechterew's students use the reflex withdrawal of the foot: the subject sits with the bare foot resting on two metal electrodes. When the faradic stimulation is given, the foot is jerked up from the metal electrodes. The movements of the foot are recorded graphically upon smoked paper. . . . We found that the reflex appears in the finger as readily as in the toe. So satisfactory and convenient is this last method that we have adopted it in all our later work with human subjects. A bank of keys is provided which enables the experimenter (he is in a different room of course, from the subject) to give at will the sound of a bell coincidently with the current or separate from the current. In beginning work upon any new subject we first sound the bell alone to see if it will directly produce the reflex. We have never yet, even after repeated stimulations,

been able to get the reflex evoked by the bell alone prior to the electro-tactual stimulation. We give next the bell and shock simultaneously for about five trials; then again offer the bell. If the reaction does not appear, we give five more stimulations with the bell and current simultaneously — etc. The conditioned reflex makes its appearance at first haltingly, *i.e.*, it will appear once and then disappear. Punishment (faradism) is then given again. It may next appear twice in succession and again disappear. After a time it begins to appear regularly every time the bell is offered. In the best cases we begin to get a conditioned reflex after fourteen to thirty combined stimulations."

Such easily-formed new associations constitute the bodily basis, in part, of those numberless sets of delicate adjustments of the muscles and glands and sense organs on which depends that capability which, lacking a better word, we have termed *skill*. No constructive mental process, *i.e.*, no learning, is possible without this marvellous ease of association-sets between the numerous different muscles and sense-organs of the learner, and between the learner as an individual and his surroundings or "environment" both of a material nature and of the kind we term spiritual or mental.

Nowhere are these hints as to the skilful motor basis of mental processes, *e.g.*, learning, more appropriate than for the practice of observation.

It must be noted, however, for future reference, that these same principles of facilitation will be applicable repeatedly in different phases of our counsel on easy-learning — in imagining, in studying, in reading, in thinking, in preparing for examination, and in actually performing this last climax of supposed educational cruelty.

More specifically for observation, however, and reduced to untechnical terms, *expert observation requires concentrated attention* (muscular adaptation under fine voluntary control) *to the entire object or process under observation, both as to its details and as to its influencing surroundings.* In other words, there must be adequate realization of the real nature of the object observed, and adapted attention to both its internal and its external relations. Such attention based on knowledge would seem to afford the best chance of the observation-process being efficiently productive of things new — new either to the individual or to the world as well. One might almost, though with some risk, epitomize the practical advice into *informed, concentrated attention to the object and its relations.*

There is a vast satisfaction, and almost a surprise, in active observation. There is no end, of

course, to "the miracle of nature", and observation gives us an acquaintance with this miracle. Indeed it is observation alone which makes this endless marvel explicit in a student's mind.

Laboratory-work, shop-work, studio-work, field-work, and all the other familiar factors in present-day practical education, are but systematized material for first-hand observation. The wide success of this method of actual, first-hand *doing* (doing and observation are one) demonstrates its supreme importance and its thorough expediency despite its great expense of time and of money. In some professional schools it has probably gone too far; but in no elementary school the world over has it gone nearly far enough — if we exclude the kindergartens. Laboratory work makes "*massive*" the facts and the principles of science, fills them out and makes them solid and substantial so that they really affect the mind. For all laboratory-work a practical point of advice is, *Follow the directions exactly and keep detailed and thoughtful notes of what you yourself particularly observe and learn* in this practical manner. My experience in the psychological and physiological laboratories has been that that is the first definite

step towards success, but very many students do not follow the directions accurately enough to be well guided in their work. Practical work is highly specialized and very complex; so that we should not fail to follow the directions exactly, all the while thinking how to develop the work. We should do no experiment save as a demonstration of some principle or of some extra-important fact. That is, we should *do no mechanical work in a purely mechanical way.* Most experiments done in a laboratory or problems worked out in field work are intended solely as demonstrations of some underlying principle, and if done in a mechanical way the exercise is worse than doing nothing at all and is not even rest. When true and thoughtful observation can be obtained thereby, laboratory work is the most rapidly mentally developing of all kinds of study. Demonstration of the extreme value of first-hand observation may be had in the vast amount of money and of time expended in the making, building, fitting, and running of academic and industrial laboratories. A school without adequate laboratories and assistants can be run for a small fraction of what it costs to run an institution with them, and that difference is very largely a matter of laboratory

first-hand observational outfit and work. Without much money, then, such courses ought not be offered at all, and indigent schools should close up.

Actual statistics based on careful and elaborate experimentation have recently thrown new light on this matter of the relative values of different modes of instruction. For example, Doctor J. E. Mayman, of New York University, has studied *physics* in this regard, and reports:—

"On the basis of efficiency as measured by percental attainments, by lasting impressions on the minds of elementary school pupils, by persistence in memory, by encouragement of independent thought and self-reliance, and by popularity among the pupils the three methods rank as follows: First, experimental method; second, lecture method; third, book method. On the basis of minimal time consumption in the actual teaching of the lessons, of arousing and holding interest and attention, and of the minimal expenditure of mental and physical energy, they rank as follows: First, lecture method; second, experimental method; third, book method. On the basis of minimal time consumption by the teacher in the preparation of the lessons, they rank: First, book method; second, lecture method; third, experimental method. . . . Carefully-written notebook work and neatly-drawn diagrams of science apparatus do not increase the pupils' knowledge of elementary science. The work in elementary science

must be concrete, and must be based on the daily experiences and observations of the pupil. Elementary science in elementary schools should be largely, if not entirely, qualitative, and not quantitative. As regards elementary science, elementary pupils cannot get the thought from the printed page. Simple diagrams are of no material aid."

These conclusions of Dr. Mayman speak for themselves.

One practical application of these results of trial and measurement is their demonstration of the *great usefulness, in the education of a boy or girl, of home-laboratories, workshops, studios, printing-offices, museums, and so on,* so often indeed found in the inner "sanctums" of boys especially — such of them at least as are fired with native energy and interest in things in general — sites of activities called by the boys themselves (at first) *play.*

But how much in human value is this play! and how vastly more could it be made the foundation of our school system! We certainly must remember effectively, making it a guide indeed to the reorganization which is on the way, that our system still is the system of Comenius, if not of the ancients, mostly traditional lore from a time when psychology and physiology, when the dependence of thought and of imagination and of

feeling and of will on nerves and muscles and glands were still undreamed.

In the address just quoted, Dr. Eliot says: —

"The changes which ought to be made immediately in the programs of American secondary schools, in order to correct the glaring deficiencies of the present programs, are chiefly the introduction of more hand, ear, and eye work, such as drawing, carpentry, turning, music, sewing, and cooking; and the giving of much more time to the sciences of observation — chemistry, physics, biology, and geography, not political, but geological and ethnographical geography. These sciences should be taught in the most concrete manner possible — that is, in laboratories, with ample experimenting done by the individual pupil with his own eyes and hands, and in the field through the pupil's own observation guided by expert leaders. In secondary schools situated in the country the elements of agriculture should have an important place in the program, and the pupils should all work in the school gardens and experimental plats, both individually and in coöperation with others. In city schools a manual training should be given which should prepare a boy for any one of many different trades, not by familiarizing him with the details of actual work in any trade, but by giving him an all-round bodily vigor, a nervous system capable of multiform coördinated efforts, a liking for doing his best in competition with mates, and a widely applicable skill of eye and hand. Again, music should be given a substantial place in the program of every secondary school, in order that all the pupils may learn musical

notation, and may get much practice in reading music and in singing. Drawing, both freehand and mechanical, should be given ample time in every secondary school program; because it is an admirable mode of expression which supplements language and is often to be preferred to it, lies at the foundation of excellence in many arts and trades, affords simultaneously good training for both eye and hand, and gives much enjoyment throughout life to the possessor of even a moderate amount of skill.

* * * * * *

"The suggested changes in American school programs will not make public school life harder or more fatiguing for the pupils. On the contrary, observational study and concrete teaching are more interesting to both children and adults than memory study of any sort; and whenever the interest of pupils is aroused, it brings out more concentrated attention and harder work, but causes less fatigue. The obvious utility of mental labor directed to a practical end increases the interest the pupils take in their work, and stimulates them to effective effort. To use a good tool or machine and get the results it is competent to produce when in skillful hands, is vastly more interesting than reading or hearing about the uses of such a tool or machine. Whenever, by the use of observational and concrete methods, the pupils' power of attention and of concentrated effort is developed, that power of attention once acquired can be exercised in other subjects. This principle holds true not only of manual or bodily labor but also of games and sports, and of coöperation in rhythmical movements, like dancing. The power of concentrated attention won in carpentry, turning, forging, or farm work is easily

transferred to work in reading, writing, and ciphering, or at a later stage in history, literature, and civics; so that the reduction in the so-called academic studies made to allow the introduction of observational studies need not result in less attainment in the academic studies themselves.

"For this great improvement in the conduct of American secondary schools a good deal of preparation has already been made. The new schools of mechanic arts, the trade schools, the various endowed institutes for giving a sound training in applied science, and such institutions as the Hampton Institute and Tuskegee Institute are showing how to learn by actual seeing, hearing, touching, and doing, instead of by reading and committing to memory. They have proved that the mental powers, as well as the bodily powers, are strongly developed by the kind of instruction they give; so that nobody need apprehend that reduced attention to memory subjects, with increased attention to the training of the senses, the muscles, and the nerves, will result in a smaller capacity for sound thinking and for the exercise of an animating good will."

So much as to the taking of notes on the tablets of our memories. Next, as to the taking of notes on paper or (in the case of youthful remote pupils) on the slate.

It has been said sometimes even by adequate university professors of some subjects, "Do not take notes but train your minds!" Now this viewpoint is correct and perfectly sanctioned by

psychology *provided*, always provided, that we immediately go home or to our rooms and run over in several good textbooks the very topic that we have just heard about in the lecture or recitation. The same thing may be accomplished by discussing a lecture with a party of fellow students. Otherwise, in almost all modern subjects, the taking of notes is absolutely essential. And these conditions are seldom met with in practice. In the first place, only a few students have a sufficiently complete list of textbooks on any one subject; and quite as few have the time or the occasion to review and discuss the topic or subject immediately after its presentation. Therefore the taking of notes would be one of expedience and is, on the whole, the best practicable means. Now, on certain subjects, even the suggested review, either in textbooks or by conversation, would be quite inadequate. Of a lecture on organic chemistry, for example, in which large numbers of complex compounds are discussed, only a small fraction could be retained by anyone, or, in any event, only at a wholly improper expenditure of nervous energy. The objections to note-taking were more reasonable two hundred years ago than they are now, for a century or two ago, a man of intelli-

gence and diligence could learn pretty much everything valuable that there was to be learned. A man in a few years could learn all the science and a considerable part of the literary knowledge of the entire world. On the other hand, to-day science and learning in general are so divided up into specialties that no man can learn in a lifetime more than one per cent of the world's substantial knowledge. Hence, written notes must be taken so that they may be kept and their details and endless interrelations conned and learned at leisure outside the lecture or the recitation-room.

Another point, already stated, is that the memory is not developable. Technically, we cannot develop our memories. It is not like an ample chest (thorax) or a good disposition, but it is more like a big foot or a large ear: we are born with them and they cannot ordinarily be improved with expediency. We can train the *use* of our memories, but it has been demonstrated that to train the span of retention practically is impossible. Memory is a birth-gift — we have a good memory or a bad memory or an ordinary memory and *we can learn how to use it.*

Notes, then, become *practically essential*, and in part, too, because of the economy of nerve-force

which the taking of notes implies. (We should not be guided generally in practice by what we actually can do: it is what we can do *economically* that counts as of most value. In the matter of exposure, for example, it is not whether we are safely to run risks of getting pneumonia, but whether it is expedient or unwise to run these risks. It is economy to stay in the house for a few days whenever we have a bad infectious cold. So it is with nerve-expense.)

Notes are essential as a means to *the formation of the habit of logical thought.* It is essential that we should arrange notes so that the facts and principles in them are presented in a systematic manner and accurately and concisely. Done in this way, the taking of notes is the quickest method of putting the mind in like logical order.

Lectures, again, are full of facts and so are textbooks, and one of the surest ways of providing the subconscious mind with ideas to use, is a studied and systematic arrangement of ample notes and the frequent abstracting of them. In this manner (probably through the motor activities required by the writing-process) the brain is impressed by a series of motor pathways as well as by a relatively ample number of sensory pathways. An impor-

tant factor in note-taking is that the notes should be arranged scientifically, and that means logically — for example, like the adequate table of contents of an elaborate scientific book. The mind works continually on the principles of symbols and of complexes, and notes are the best possible means of providing economical food to the brain and to the mind. We should have center-headings, side-headings, under-lines, and, in many cases, the use of different colored crayons for the impression of this essential logical subdivision. These manual means represent the many different sizes of type and type-faces in a printed book.

Another reason for the use of notebooks lies in the familiar fact that ideas may come out of the associating mind and yet be wholly lost to that mind unless secured for future incorporation. In the composition of articles, the elaboration of explanations or of hypotheses, and especially in psychological and mathematical analysis, this necessity for fixing the elusive ideas is often conspicuous. *Effective mind* is what counts; knowledge, systems of ideas, purposes, understanding which may be *used*. Sturt, the idealistic logician at Oxford, expresses it well: "Truth-seeking and truth-finding are subordinate

to the formation of purposes and the satisfaction of desires." Many new products, especially if somewhat incongruous with the working mind, wholly escape, and perhaps escape for good, unless recorded where, in the practical sense, they may be *learned*, that is made *usable*, — for this usability is included in all real learning, in the kindergarten as well as in the seminar.

As corollary of this approbation of note-taking is their value, often tremendous, as cues or stimuli of knowledge and thought after — perhaps many years after — the notes are made. Every thinker and every writer realizes this thoroughly. His notes serve the purposes of the sketches of the painter or the recorded themes, motifs, and "snatches" of the creative musician. In general the old-time and now outworn adynamic notion of mind has sometimes unduly prejudiced the value of notes, oftentimes *the seed of a rich harvest*, immediate or remote. It is perhaps not generally enough realized that a mind may produce things and then utterly lose them.

A *notebook* should be made of large pages, loose pages preferably, and unruled, so that we shall not be confined to handwriting of a certain size. If unruled paper is used we have not only a chance

for much more freedom in that respect, but a chance also for pictures. An 8 × 11 inch notebook is ideal. Pocket notebooks are extremely important. We should take a notebook with us almost wherever we go, if we are strongly ambitious to learn broadly and accurately as the years go past. These "commonplace books" in a way serve also as a history of our education.

In the taking of notes the use of *abbreviations* is of the utmost importance. We should develop easily a code of our own; shorthand is almost indispensable for the student, but we can easily develop a useful system of abbreviations of our personal invention much more quickly than we realize; in the passing years such a system will save much time. These abbreviations are for the purpose of saving time, not paper. In lieu of a fountain pen, use plenty of soft pencils; and acquire the habit of using many colored grease-crayons.

Diagrams are sometimes of immense importance in the taking of notes; in general they are of value as much according to their simplicity as at other times according to their complexity; so we must not refuse to copy a diagram because, as we often hear, "I cannot draw." We acquire the habit of

drawing diagrams much faster than we realize, and, when drawn, each expresses much for the use of the associative mind. The making of *graphs* is of great importance because a graph oftentimes expresses more than could whole pages of technical description, — and far better, too.

Reviewing notes is of much importance. Prof. H. A. Peterson, of the Illinois State Normal University, says on the measured effects of reviewing:[1] —

"The purpose of the study is to get some measures of what reviews accomplish under conditions similar to those of school work. The subjects were normal school students in classes of from 45 to 75. The class was divided into two groups of about equal ability determined by means of a prose-substance test. All were then given $2\frac{1}{2}$ minutes for studying a passage 25 lines long, followed by an immediate recall (written) for which a maximum of 12 minutes was allowed. The aim was to reproduce as much of the substance as possible. In grading, one point was allowed for each idea. A week later while one group was occupied with the class work, the other reviewed and re-wrote the passage, the purpose of this re-writing being simply for fixation. Two and one half minutes were again allowed for reading and a maximum of 12 minutes for writing. In some classes there were three groups, the third group receiv-

[1] In a paper read at a recent meeting of the American Psychological Association.

ing a second review two weeks after learning. Three, four, six, or eighteen weeks after first studying the passage, the final recall which measured the effect of the review came.

"The results so far are: After three weeks the one-review group recalls 1.89 times as much as the no-review group. After six weeks the one-review group recalls about 1.33 times as much as the no-review group, and after eighteen weeks the superiority of the former has sunk to about 25 per cent. After six weeks the two-review group recalls about twice as much as the no-review group, and after eighteen weeks the former recalls 1.8 times as much as the latter.

"While the reviews here used were undoubtedly thorough, the results probably exceed the most common expectations. While the effect of the review, like that of the first learning, decreases rapidly at first, and later more slowly, a substantial residue remains after the sixth week. All of the results were obtained from the use of a single historical selection of only moderate difficulty."

The reason for these results we do not need to discuss in detail. They depend on the principles of habit-formation, that universal process underlying all that lives, which later on we shall have need of considering briefly in sundry connections.

Laboratory notebooks are extremely important in education. They are so especially because they constitute the records of *discovery and research* so far as we, at least, are concerned. Laboratory or

field work on nature at first hand, so far as we are concerned, really is research and discovery no matter if the facts have been discovered by others before us.

Notes nearly always should be in our own words. Otherwise they are "cribs" for the mind's use and properly not notes at all. A good lecture is explanation and not dictation of a set of cribs; not description but *explanation.* In some schools there is far too much lecturing and far too little studied review of textbooks by means of recitation. The same is equally true of books as of lectures. Notes are of no real educative use unless or until they have been sufficiently worked over in our minds as to be expressed readily in our own words. Therefore, the importance of using our own English. There is no rule for this better, perhaps, than taking notes "just as we would talk them to a little sister seven years old at home" simple and direct and explicit.

The subconscious mind fuses and retains the facts on the principles of symbolic action, and continually elaborates them. That is one of the important reasons for taking adequate notes. Each note should serve as a *symbol* by which the mind (and nervous system) can get hold of it

and connect it for use with other facts and other principles already secured.

We should keep our notes always posted up. I do not mean summarized daily in writing, but I do mean posted up in the brain. Notes which are not reviewed become dead notes (rests) in a few days! It is not really necessary to summarize notes in writing in the notebook, but in keeping them mentally posted up we train the mind always to be abstracting. We should make notes as we would like our minds to be: First, *abundant;* second, *accurate;* third, *logical;* and, fourth, *free.*

Another thing worth considering, perhaps, is the importance and practical *value of preserving notebooks* (the same being true of textbooks). In the first place, they often are practically useful later on in our careers. Many of the courses given by students soon after leaving school are practically the reproduction of the lectures which they have had in school! Second, good notes are part of the mind just as our mothers and our sweethearts and our childhood-homes are parts of our personality (see James's "Me"). More than that, our sons and daughters may, and probably will, value them at some future time. In a later

discussion we shall consider our notebooks in relation to examinations.

Another important thing in the taking and the learning of notes is the *forgetting* of things which should be forgotten. It has been said by some psychologist that forgetting is only less important than remembering. By glancing over our notes we may select the important things and neglect the dead and adynamic things which are to be forgotten passively. Nothing once impressed, it seems, ever leaves the brain, save by gross loss of cerebral tissue; the impression in some form continues during life. What we actually have in our recallable working minds is, then, only a small fraction of what in some mysterious manner is impressed in our brains. So it is true that only a relatively small portion of the notes can be remembered properly; the rest may be forgotten. Some things are quick, and become active agents in our education; but some, too, are wholly dead for us, and are (and should be) lost out of our effective minds.

CHAPTER III

EDUCATIVE IMAGINATION

In the previous chapter we ran over some of the practical considerations of observation and of taking notes, both on the tablets of our memories (observation) and on tablets of paper, — note-books. How, practically, we can further the use of these notes, both cerebral and manuscript, in the learning-process, is our next inquiry. This process in practice may be analyzed and understood, and thus improved materially, in any given mind.

Imagination, as we shall discuss it, may not be easily defined except by suggesting what it is not: It is not falsehood and untruth, but a most essential form of mental truth; and educationally it is of great practical use and importance. We may wonder how imagination, as we think of it, can be important in learning at all. The reason for this doubt is that a wrong meaning of the term "imagination" has crept into general un-

technical use, namely, that it is delusion, a false idea, an error of thinking, the seeing of something that is not there; false perception — in other words, error and falsehood rather than something which is true and real and in every educational way important. Imagination, on the other hand, is one of the most productive mental processes in the whole educative procedure. It is "the representative power" of the mind, but this, as we shall see, involves much, since in a broad sense it includes many of the active constructive operations of the mental life. Dean J. R. Angell, the eminent psychologist of the University of Chicago, emphasizes the two leading features of imagination when he writes that it "is to be viewed not only as the process whereby the ordinary practical affairs of life are guided, in so far as they require foresight, but also the medium through which most of the world's finer types of happiness are brought to pass." Surely a thing which at once guides our lives and gives us happiness is of much account; and in the learning-procedure it is not of less account than elsewhere. Imagination may be denoted as the use of the mind backwards or forwards, turning the mind into the past or into the future but not directly into

the present. Although one of the most conspicuous aspects of the nature of imagination, this is only one.

Memory is a form of imagination called *reproductive* imagination. Foresight, in a broad sense, is another form called the *constructive* imagination, which, however, we shall discuss in a way to include a much more active process than this. Influence of the mind on the body is called *organic* imagination. Each form has notable practical concern in learning. Our present search is as to how this fact is so and as to the practical means of developing imagination, if not already ample and rich, in ourselves, and in our pupils or students.

Let us, then, take up these three kinds of educative imagination, one after the other, and see what we can suggest about them in the way of practical use in easy learning.

Reproductive imagination is memory or recall. There is evidence that the nervous system retains every clear impression made on it, but how long we do not as yet know. A great many cases have occurred from time to time which demonstrate that in some way this is the case. There are three general types of retention-memory that

have more or less to do with the reproductive imagination. Some of these "memories" are hereditary and inborn, and are represented in the spinal cord — *the reflexes*. The sneeze, the cough-reflex, and the like, are more or less unintentionally performed and controlled. Then there are some memories which are controlled further up in the brain, the *instincts and emotions*, having social as well as personal reference. It is important for educative purposes that the latter memories involve the previous kind as well. The third type of the reproductive imagination is located in the upper extremity of the nervous system — in the cortex of the brain. These are the latest additions in the evolution of the brain, *memories proper*, and only a few of them are conscious at any one time. These last, like the preceding, should completely involve the other two.

The fundamental principle of *habit* is what determines the usefulness of these forms of memory for easy learning. Their respective power of recall depends on their relative influence on the more conscious parts of the brain. There is, then, one general learning-principle — that *all these three kinds of memory should be given habitual*

yet conscious reference, as conscious as is voluntarily possible. Reduced from physiological to practical terms, this means that we come again to the *skill* which we discussed in the last chapter — conscious acquaintance with and mastery of all parts of the body that may properly come (without interference with function) under voluntary control. This is one of the physiologic bases of rapid and permanent acquirement. By this means every learning pathway is open for use in the acquirement of knowledge. Here physical training gets its highest sanction and usefulness, as the writer has set forth elsewhere at length.

The power of recall of what once has been remembered is one of the essential things for learning. The perfection of the memory-record is beyond control, but this power of recall may be greatly developed. We must remember continually that the brain acts more or less on the symbolic system, using a method of shorthand symbols, which are in some way impressed in the brain processes; these are essentially neural or neuro-muscular *integrations*. Hence the need of *reviewing:* in order that these associations or integration-complexes may be connected more intimately together, and as a complex with the

rest of the mind. Recall is thus made easier and more useful, for facts and their relations are sorted out and oftentimes labeled with a name, as with all "general ideas." By this means and perhaps only thus they are made available for use at will.

Another practical point for the use of the reproductive imagination is that *it should be impressed with a feeling-tone of some sort.* It is the emotional tone of nearly everything of a mental nature which gives it its "push" and determines its useful activity. The exact kind of feeling for this purpose is not so important as is the bare fact that the memory always should be associated with *some* sort of feeling-tone. Feeling and not the idea is the mind's great energizer. Therefore, in general, we remember best our pleasant (or very unpleasant) experiences. At the first glance over our memories, that does not, perhaps, appear obvious but in the long run it is distinctly true. It has recently been shown by actual experiment that young school-girls, at least, remember best their pleasant experiences. In other words, other things being equal, we should study chiefly and should remember those subjects which are pleasing to us. This is one of the reasons for the privilege of selecting subjects

of study in school, — the "sanction" of the elective-system.

When the reproductive imagination (memory) seems wholly perfect to the individual, the experience is called an hallucination. Thus when we have an hallucination we perceive something which is not really there at all. This happens only under conditions of mental overstrain or of derangement of some sort. So far as the perfection of recall is concerned, it is quite impossible for a really perfect reproduction of the original impression to occur. The moral of this discussion of the imperfection of the imagination is that the memory is never exact. Recall is never normally exact, and the student must act on this principle in all ways.

Nevertheless the reproductive imagination is often of very great service in learning, both in the recall of words seen and heard continually, and the like, and in picturing to ourselves for use the conditions of hidden or absent structures. We have already noted how indispensable the visual imagination, in both its reproductive and its constructive aspects, is in anatomy, physiology, geometry, physics, and so on. The same is almost equally true in many other sciences — in

fact in most branches of learning. The difference, for example, in the liking for or dislike of geometry by students sometimes depends largely on their relative power of *visualizing* the spatial problems involved. Therefore, *we should develop to its limit this power of seeing things in the mind's eye* — and of hearing them, and feeling them and smelling them and tasting them. Thus the material world is, for educative purposes, extended in far wider mental relationships than otherwise.

The second form of imagination which we shall discuss is *constructive imagination.* For educational purposes, this is by far the most important of the three. The reason that recall of our memory is never exact is that the mind is an active process, always *doing* something. The neurons are alive with energy and always develop their mental contents when not in some way prevented. Thus speaking educationally, all imagination is more or less constructive. You have heard it said that we learn to swim out-of-water in the winter-time, or to play tennis; we sometimes learn to love a person better during his absence, which proverbially "maketh the heart grow fonder." These are all processes of constructive imagination; and in the last case, when

we get back to the beloved person we sometimes realize the constructive difference. All this, of course, is an important subconscious process: but in the human mind at least, imagination has more power than this relatively passive process of subconscious elaboration.

A research [1] made by the writer gives a concrete illustration of the active, image-making "association" in the minds of people: —

A STUDY OF IMAGINATIONS

To "see things" in the ever-changing outlines of summer clouds or among the flames and embers of a fire, has doubtless in all ages been to imaginative men a source of entertainment and delight. Much of the charm of this pastime comes no doubt from the commonly accompanying circumstance of leisure, and from the novelty of exercising an aspect of mind all too little used and given freedom. Another element in the interest of the habit, however, comes from the endless variation in the forms which different persons fancy from any given contour or in any simple presented shape. For the purposes of

[1] Published in *The American Journal of Psychology* in January, 1898 (volume nine, number two).

studying the reproductive imaginations of men and women, the psychologist might well desire to take the clouds into his control and bid them serve him; but they are far beyond him and will not for a moment stay.

To reproduce, then, under applicable and controllable conditions these familiar studies of human fancy, the following simple means have been adopted, and they constitute the complete apparatus, simple enough, of the investigation. Chance blots of ink, made by pressing gently with the finger a drop of common writing fluid between two squares of paper, furnished all the variety of outline imaginable. (More explicit suggestions for the manufacture and usefulness of these characters introduced as psychological material by the author, may be found in the *Psychological Review* for May, 1897, page 390.) The bits of gummed paper 3 c.m. square bearing the blots, scarce any one of which resembled any other, were then attached to cards convenient for the hand and arranged in twelve sets of ten blots each, the members of each set being numbered consecutively from one to ten with Arabic and the sets themselves in Roman numerals. Thus the back of every blot-card bore a number by

which it could be registered and identified. The uncommonly great interest of the subjects in the research was largely due to the great variety in the configuration of these blots, and to secure the constant attentive effort of the subject is often no easy matter, although sometimes this means half the research done.

The subjects were mostly students in the Harvard psychological laboratory, although professors and their wives and one Latin-school girl were among the rest. The range of ages was between eighteen and sixty-two and the average nearly thirty-five. The subjects were employed as was convenient, no selection of any sort being made, and hence they may be said, as far as any relation to imagination is concerned, to have been an average set from their particular social grade of culture and education. In the case of every subject some brief sketch of his or her early life was obtained as regards familiarity with various animal forms, and concerning fairy stories, mythology, and the like, and as regards possible habit of watching clouds and other natural forms as a pleasure of the imagination. It was expected that subjects raised on a farm, hunters, and artists would have a store of advantage over those of

contrary habits. Among the subjects were two poets and two artists, and all of these were well toward the top in readiness and variety of response. One of these two poets made the shortest average of times, and the subject who had the longest average is a young man little fond of verse.

The experiments were conducted with the subjects always in normal condition as far as could be learned, and at an average hour of the day as regards fatigue and meals. Each was particularly instructed "to look at the blot-card always right-side up, turning neither the card nor the head; to try to employ the whole character if possible, not allowing it to separate into parts while being observed; not to be too particular to get a perfectly fitting object in mind, but to tap at the moment of the consciousness of the first suggested image; to react by a sharp tap as promptly as possible; to report each concrete object suggested as concisely as possible, with any suggested general action of the same, and, especially, only such details as occurred before reaction by the tap." The method of the experiments was, then, simply thus: A set of blot-cards being arranged in order face down and a stop-watch in hand, after a warning, Ready!

one second previous, a blot was quickly placed before the subject at his or her proper visual distance. Upon the discovery of the blot's likeness to any object, the subject tapped and, the time being registered, a brief description of the suggested object was recorded opposite the number of the character; and so on through the entire series of 120, or, more commonly, until decrease of interest or evident slowing of reaction indicated the beginning of fatigue (which was carefully inquired after and noted), when the experiment was promptly suspended for the time. None of the subjects had seen the blots before the time of the experiment.

As would be supposed after observing the different characters as represented in the illustration, most of the replies to the general question, What is it? were various in the extreme. This variation is least in set number one, as the blots of that file were selected and placed together as the first set, that their relative easiness might compensate for the novelty of the experience and slowness of reaction in unprofessional subjects.

The figures in the accompanying table indicate in seconds averages of the times for the ten blots composing each set. In these results the inter-

esting cases of apparent inhibition are included, it being practically impossible to discriminate such cases of exception from slow examples of associative imagination, and no cases of inhibition being long or frequent enough to essentially vitiate the average of any subject. These periods of inhibition have an interest in themselves, for although much like ordinary cases of amnesic aphasia, they differ from them in that here the blocking seems to be among the

Subject.	Approx. Age.	Average Times, in Seconds.												Av.
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
A.	23	5.4	4.6	4.3	9.0	4.3	7.6	6.8	8.2	6.8	14.8	8.5	7.8	7.3
B.	28	5.3	13.4	16.1	4.7	13.7	16.2	6.3	23.6	5.3	31.2	8.0	11.3	12.8
C.	21	6.3	15.0	14.2	8.4	14.1	27.5	15.5	12.5	12.4	8.4	8.1	8.6	12.6
D.	24	3.2	12.5	25.1	10.7	13.1	27.8	30.0	23.0	15.4	4.0	3.5	7.9	14.7
E.	22	5.3	4.0	9.6	9.5	10.2	12.4	19.5	9.6	7.3	12.0	11.8	8.9	10.0
F.	30	18.7	13.1	8.8	4.6	8.0	9.5	8.6	7.1	4.5	8.3	10.2	6.1	8.9
G.	27	6.3	23.3	9.8	6.2	18.6	9.4	10.2	31.7	11.5	19.4	11.9	17.6	14.6
H.	60	16.4	9.0	22.4	11.5	16.4	6.2	7.3	10.6	14.9	16.6	32.6	21.6	15.5
I.	30	25.3	30.3	25.3	17.6	5.4	11.8	21.3	14.0	37.1	13.8	19.6	14.0	20.0
J.	18	12.1	10.4	13.7	13.3	9.7	21.9	27.4	16.2	14.1	15.1	14.1	11.7	15.0
K.	29	2.3	6.7	6.1	4.0	6.3	8.9	8.8	10.7	7.5	13.8	14.6	14.7	8.7
L.	29	3.8	1.3	4.8	2.9	2.2	3.8	4.9	2.2	3.3	5.0	1.8	3.4	3.3
M.	62	1.9	3.2	8.2	2.5	2.4	2.5	2.4	1.8	2.1	1.9	1.4	1.6	2.7
N.	61	2.5	6.6	15.7	5.2	4.7	9.2	2.0	4.9	6.4	10.4	5.9	4.6	6.5
O.	39	6.5	4.7	2.1	3.0	5.9	3.3	5.3	5.9	6.7	7.0	3.3	8.2	5.2
P.	34	5.7	7.5	11.6	3.5	3.3	7.0	14.6	7.5	6.5	7.1	4.1	6.2	7.5

Grand Average, 10.3

brain paths or currents representing objects instead of among those representing words, as is the common case. Perhaps for a minute or two the subject would sit staring at the blot, but wholly unable to see any resemblance in it to any object, and this wholly independent of any inherent oddity of the character, and of inattention. The real nature of these inhibitions is a problem for further research to answer. If arising from confusion or indecision between two or more resembling objects, such confusion or indecision was in these cases wholly a sub-conscious process, appearing to the subject almost always merely as a cessation of "mental activity."

The often considerable number of vacant seconds which elapsed between the application of the stimulus and the reaction image, offers a striking illustration of the entire sub-consciousness of the processes of reproductive imagination, but including in these cases much more. Here was presented a blot of ink, perceived by the subject; the next thing in his consciousness was a name of some object resembling in some respect or many the stimulus, so that a complicated process necessarily intervened. Many ancient pigeon-holes of the brain must have been searched,

and a comparison made with the contents of each, followed by a judgment of greater agreement in some one case, a choice thereof, and the calling-up and utterance of a name, which again became consciousness. And this often in a fraction of a second. Such, we may conjecture, is the general process, although the many attempts at introspection gave wholly negative results. Frequent inquiry was made as to how, in what form, the suggested object came into consciousness, and *the most frequent reply was that a name, articulate, visual, or auditory, was the first of the object experienced.* Sometimes, then, it was once or twice said, the connotations of the object developed. In some cases aphasia occurred and a hazy likeness of the object coming hovered for a few seconds or less before the mind. Here is a problem for research.

Instruments of precision for measuring small periods of time were not needed in these experiments, but intervals of not over half a second appeared in several instances, such reactions being as fast as regular time-reactions with judgment or choice, and much more characteristic of the reacting subject than of the blots on which the reaction occurred. The longest time required,

three minutes very nearly, was by the subject with next to the longest general time average also; the two next longest were by two students of decidedly "intellectual type." Neither age nor sex shows a distinct influence in these quantitative results; habits of living, on the other hand, are clearly recorded in the figures as confirmed by knowledge of the various subjects' mental modes and occupations. The intellectual type appears in the numbers with like corroborative evidence. From the grand average of all the subjects' times, about ten seconds, it is apparent that the reactions were slower than one might *a priori* estimate from a study of the blots. Facility developed noticeably in some cases. It is curious to observe that an equal number of subjects were above and below the quantitative average; also that the slowest and fastest were nearly an equal number of seconds from the mean time, which thus doubly appears to be a true average time of these 1920 reactions. As a comparative mental test, this mode of experiment would seem to be valuable, representing accurately the mental functions upon which wit and mental liveliness depend.

The qualitative portion of this research has

more of interest than the quantitative, howbeit its results are not statable in exact terms nor expressible in figures. The qualitative side better, however, suggests the mysteries of association and of the imagination, deep in the nervous substance, which future psychologists may explain. Each subject, it will be remembered, was instructed to report the *first* object which the blot suggested to him in each of the 120 cases. A comparison of these object-images gives, therefore, curious and interesting results, and leads into mazes of scientific conjecture.

In the case of no blot did over 40 per cent of the subjects agree on any one suggested object. In several instances no two of the subjects were reminded of the same thing. These two extreme blots are reproduced in Figure 1, the right blot,

XII, 7. X, 10.

FIGURE 1.

numbered X, 10, having given the 40 per cent of agreements, and the other, XII, 7, being one of those upon whose name no two agreed. Critical

study of their outlines gives only one key to this great difference in difficulty, namely, that the one upon which there was agreement strongly suggests the familiar figure of a man (with upturned coat collar).

From out of the 120 blots three have been chosen here as examples for a full report of the subjects' answers, the times being also given for greater completeness. These three characters are reproduced in Figure 2, and their respective descriptions follow: —

III, 1. VIII, 10. IX, 4.

FIGURE 2.

III, 1.

SUBJECT.	IMAGINED OBJECT.	TIMES. SECONDS.
A.	Cabbage head.	3.
B.	Animal with mouth open.	46.
C.	Fairy on a cloud.	11.
D.	Woman, seated, basket of vegetables in her lap.	12.
E.	Top of an Indian's head, nose swollen.	4.
F.	Grotesque Indian's head.	22.
G.	Rabbit sitting hunched up.	16.

H.	Potted plant on the ground.	7.5
I.	Rooster sitting in a bunch of vegetables.	44.
J.	Grinning head of a beast.	3.
K.	Head of chicken with a top-knot.	2.
L.	Monstrous man's head.	1.5
M.	Flower.	2.5
N.	Cock's head, comb erect.	4.
O.	"Punch."	1.5
P.	Head of a woodcock.	6.

VIII, 10.

Subject.	Imagined Object.	Times. Seconds.
A.	Puritan scold about to be ducked.	9.
B.	Woman extending her hand.	2.
C.	Veiled woman on a stool; basket at her feet.	8.
D.	Woman on stilts.	16.7
E.	Mermaid enveloped in her hair.	6.
F.	Fore part of a grazing deer.	3.3
G.	Bear.	4.
H.	Man sitting on the limb of a tree.	3.8
I.	Monkey on a three-legged stool.	4.5
J.	Dog, tail very straight.	7.
K.	Man digging.	3.
L.	Girl in a high-chair throwing something into a basket.	1.
M.	Chimpanzee.	4.
N.	Old woman sitting on a tub on two legs; children at right.	1.3
O.	Person sitting on a person in a chair.	4.
P.	Woman sitting on a rock.	4.5

IX, 4.

Subject.	Imagined Object.	Times. Seconds.
A.	Demon on a beast.	4.
B.	Monster's head.	16.3

C.	Head of an Arab.	8.
D.	Running animal frisking.	2.
E.	Girl in a tall cap, seated.	4.
F.	Running pea-fowl, head on one side.	6.2
G.	Chimera.	11.5
H.	New style lady's bonnet.	70.
I.	Head of some one-eyed creature.	33.5
J.	Bat, flying.	47.8
K.	Two shrimps.	20.
L.	Child falling from a tub, falling from overturning stool.	2.
M.	Half of a sweet-pea bloom.	3.5
N.	Snake coiled around a stick.	3.
O.	Horseshoe-crab.	5.
P.	Human head (left part of blot only).	21.

Why one subject should see in a blot a "cabbage head" and the next an "animal with his mouth open", or why a professor should be reminded by a blot of "half a sweet pea blossom" and his wife of a "snake coiled round a stick", of course no one can at present pretend to explain. There is a temptation in such cases of association as these to call the results the choice of chance, but this means too little — or too much. It is clear that, as a general principle, *the experience, and especially the early experience, of the subject has important influence.* For example, study of the records shows that subject H., a purely domestic woman, is reminded most often of domestic objects; while subject O., who is an artist

and student of mythology, sees in the blots many picturesque and fanciful things. The difference between the imaginations of the country and city bred is clear. Altogether there is evidence here that *the laws of the reproductive imagination, still for the most part hid in the neural paths, are substantial laws,* which may one day be found entirely out and reduced to words and to more or less of mathematical certainty of statement. Meanwhile it is something to establish, if possible, in a manner unmistakably demonstrable, the empirical conditions under which this "faculty" of mind performs its marvelous combinations and effects, for the imagination is one of the most interesting as well as most important phases of mentality.

In particular would it be interesting to know to what degree, if at all, the fixed ideas, delusions, and changed emotional conditions of what the Germans conveniently term *der Wahn,* influence and subvert the reproductive imaginations of the persons who are the victims of these obsessions and delusions, fixed into their mental natures deep as life.

The pleasantness of this image-making phase of the mind's process is distinct and is not a little

of the permanent satisfaction which is part of the reward of the labor of "acquiring an education" — an outworn and now somewhat misleading expression, but none the less denotative of what is meant here. Nothing more sharply marks off the boor from the gentleman than a lack of this creative fancy. It should, then, be acquired for its own sake, as well as for its educative usefulness.

Observe that here, too, is distinct evidence of the motor basis of a psychic function as subtle even as fancy: the suggested "object" came into clear consciousness most frequently as "a name, articulate, visual, or auditory", in short, always a body-derived symbol, a motor correlate. Here again bobs up our *skill* so often referred to in these pages, the term in itself a symbol of fine neuro-glandulo-muscular adaptation. These imaginings were relatively *free* associations, and they certainly have an importance of their own in easy, as well as in pleasant, learning. Cultivate them, therefore.

We have, however, in addition to this, the ability to *force* the constructive imagination, just as we have the power strenuously to work out a line of thought, for example in writing a "composition", an essay, or a book. All real education is

developed thus — by the unrolling of intelligence out of materials obtained everywhere and all the time, and in all probability, mostly subconsciously. We may have much knowledge and even learning, but not *education* without this constructive process of imagination. The more conscious this construction, the better and more useful for the student. When conscious this is called thought (technically "ratiocination"), which we shall describe and apply later.

It is interesting to consider a little more in detail this deliberate constructive imagination. It is really a very remarkable process, which we well may try to analyze as a type of constructive mentation. There is such a large individual difference in people that it is scarcely possible to find two who will agree to the same statements as to the facts. But none the less we may take for an example a musical theme, or a simple melody commonly called a tune; heard once, in my own case, this is not recalled, save in the smallest bits, a bit here or there in attenuated form. But heard twice or more, then three or four days elapse with total submergence, that is, nothing at all being heard from the melody. Then, curiously enough, it begins to become conscious, now

and then a strain here or there of the air or theme. If then I hum or play a few strains, the missing parts, more or less complete, soon appear, but gradually and in fragments, especially if I whistle or play these fragments on some instrument. *Performance* of some kind is generally essential to recall. We have to push the imagination-association. The process is actual repetition, even to automaticity, even to triteness. If the new tune is attractive (a complex quality psychologically), there is a distinct tendency to hum it and sing it until it gets more than tiresome. Obviously it has by this time become a real part of the effective mind. Then, perhaps more or less actively, it sinks into the subconscious aspect of the mind, having been repeated until it is positively unpleasant to have in consciousness. When a tune has become so familiar on a basis of pleasure, it tends thus to repeat itself even to dismissal. It is in this way that the constructive imagination works.

This may be employed as a useful type of this form of imagination and from this illustration we may suggest more details adapted for the process of learning. Let us analyze a little more fully what has taken place in this common experience

of learning (by the constructive imagination) an ordinary sequence of musical tones. We find six more or less obvious but yet arbitrarily chosen elements in this process. First, there is an impression on the mind, which is subconscious therein, or in the nervous system, as we may state it. Second, we find a process of unconscious integration, in which period (several days in the case used as an illustration) there is no awareness whatever of the integrative process that is going on. Third, there is a fragmentary flotation into consciousness and the fragments are then made more conspicuous by action, and by repetition. Fourth, there is a process of conscious integration by effort; this is by far more effective if it be helped by motor performance such as humming, singing, playing the tune on some instrument, or whistling. Fifth, there is a stage of conscious familiarity or even of over-familiarity. And sixth, there is a real mental submersion, the melody being present then as *real knowledge.*

Now I take it that all matters of knowledge, all acquirement occurs more or less in this same way, whether the precise learning be that of the Constitution of the United States of America, or a list of the Presidents and their life-data, or the

irregular French verbs, or the rule for finding the cube-root, or the provoking and absurd "rules" (seldom followed) of Latin grammar, or a set of propositions in geometry, or the physiology of the regulation of the body-heat, or the geologic periods, or the theories of heredity, or what not. The process always seems to be in some degree the same as in the impression and recollection of a new melody. Let us work it out practically for our immediate purpose: —

The material to be learned is read through once or twice, but, being relatively difficult, is not consciously learned. The practical point here, is the importance of *concentrated attention* on the more difficult and arbitrary material in a subject of study, in order to impress the brain all the more vigorously. Retention would often be aided too, as has been said, by doing this study with some emotional tone, preferably one of great determination or of enthusiasm, even anger; but not worry, a form of fear.

The mind, finding the material consonant and its acquisition expedient, works it over, not only within itself but more or less also with the former contents of the mind. The practical "moral" of this interval is obvious: — *the value of review*,

which reinforces the impression on the brain. Another moral is *peace of mind and absence of worry*, — implying implicit trust in the subconscious fusion-process of the mind.

Fragments here and there float into consciousness, so that we are reminded that the mind is working on them, and thus is kept at it. We should *learn to attend to our "subconscious"*, our "oversoul."

At the next attempt at learning (whether it be a few hours away or a few days), effort is used, what we call conscious study, and we find integration easier than before. *Going over the same material* to be learned, after a few days, deliberately and carefully once or twice, *lends confidence in the mind* by showing that processes are helping which are unknown to the student at the time.

The stint is then learned and we are conscious of the fact. Here work, and especially motor expression — work on the material, is very productive, making it thus thoroughly familiar by the instinctive pleasure of creation, of learning, and on the physiologic principles of imitation and of habituation. *The importance of working over the material in some motor way* (usually writing it

or talking it to some one, if it be only to ourselves) comes out here; also the importance of repetition.

The material is then "forgotten", or so-called forgotten; but in reality it is truly learned and is in the mind in the best possible form for use as required, or when by chance the association-cue is given.

Such are some of the practical hints toward easy learning which may be suggested even in a process as abstract as the constructive imagination. The reader can do similarly for other learning-processes, but this or something similar is the standard *modus operandi* of the learning mind, at least when working on all series of difficult facts and principles. The less arbitrary and more interesting the material, the easier this mental process is and the simpler, although the same in principle. This is the process sometimes known as the association of ideas, and we may try to analyze it a little better in the light of the actual association of the actual tune offered as a type.

A practical point may be noted here. If the desired thought or relation or whatever else be the kind of associational process desired cannot be produced by a few minutes of really concentrated effort, it is not scientific to try further

at that time without a break in the mental effort. We should rather await a brain refreshed by a little rest and helped by the subconscious integrative actions that are pretty sure to be set going by the conscious effort already made. When the problem is taken up consciously again, later in the hour or the day or the week, the chance of success, other things equal, will be much improved and that without risk of uneconomical fatigue. Moreover, there is in this constructive learning such a thing as absolute block of the will, — else of course there would not be the empirical, definite limitation of ingenuity and invention. I recall an instance in which William James, master in constructive thought, showed just this phenomenon before a small class in philosophy, — he said, after a minute or two of strenuous effort, that he had tried repeatedly to work out that particular thought, but that he *could not* advance his construction beyond a certain relatively incomplete stage.

Imagination of the thinking kind tends to make ideas more "massive" and so more educative. Massiveness makes them easier to realize in their actual meaning; in this case more imaginable.

The next topic in regard to constructive imagination is the matter of complexes of mental units. Knowledge in some way is in the mind in the form of mental integrations. Morton Prince terms these "dormant ideas", but obviously units in some sense or other although not yet clear to physiology. These mental units have dynamic relations which they and the nerve-energy have in common, so that "ideas", especially when colored by a definite feeling-tone, have an inherent impulse to interaction.

Therefore an effort should be made by the student in all ways to make these complexes, (1) as *numerous;* (2) as *complex;* (3) as *active;* (4) as *permanent;* and (5) as generally *useful,* as possible. The process of so making them is *effort,* and is at once imagination, thought, association, and remembering combined. Now, (1) we can make these complexes of the mind, these dormant ideas or units of mental process, more *numerous* by reading, talking, by taking notes, by observation, by thinking; in short by all the common modes of acquiring new concepts or ideas, or by expressing them.

(2) We can make them more *complex* by practically the same means.

(3) We can make them more *active* (a) by including in the complex an emotion or a feeling. These constructive complexes in the mind may be made more active also by (b) developing interest, instinctive or personal, and (c) by association with material which already has interest or emotional tone for us. William James has emphasized this last essential fact in his "Talks with Teachers." He says that "any object not interesting in itself, may become interesting through becoming associated with an object in which an interest already exists." It was likewise found by Pavlov and more recently by Watson at Johns Hopkins University (as discussed in the previous chapter) that there is no assignable limit to the arbitrariness of the association that may be "artificially" made in the nervous system. Nerve-surgery suggests precisely the same thing, for, as has been often shown in practice, a cut sensory nerve may be sutured even to a motor nerve stump and the sensory function sometimes return in all its essential completeness. There seems to be no end to the power of association or of adaptation possible in the nervous system, especially in its more liquid gray-matter.

(4) *Permanency* of the mental units or com-

plexes may be reached best by way of (a) emotional tone; (b) by the richness of the recorded relationships; (c) by the intensity of the personal attention when the perception first takes place; and (d) by the frequency of review; these among other means.

(5) The *utility* of the mental complexes or units is reached automatically by the mere avoidance of thoughts and the like of the Scholastic type, problems and theories which have no deeper reality or basis in fact than the chance relationships of pure ideas, which often in reality are only verbal quibbles. For the most part, we should think of and discuss real problems with some really human applications, — and with some really human man or woman, too.

Originality, ingenuity, grace, skill are terms for various phases of the productive and efficient constructive imagination. A man or woman who lacks these is not educated. Skill, as we saw in the previous chapter, is a kind of potential imagination. We may suggest a working rule for becoming able in this line of constructive imagination, even if it be in almost slang terms: *Get posted; get energetic; get interested; get busy; and TRY. And keep on trying.* In any intelli-

gent mind trying develops its own personal method, and we cannot be told how to improve these methods in the subconscious mind. Habit makes it easier and easier to remember, and more and more productive as well as easier. Constructing and the general use of the constructive imagination becomes after a while in itself (something too of delight which we always have ready at hand) a vast pleasure and delight. Not only in ideation but in feeling and willing, is the mental activity worth cultivation for its own sake, and like virtue and beauty it is its own reward.

Feeling-imagination lends emotional tone to the mental process and so gives it delight, or at least satisfaction, as well as power. This may be seen readily in poetry and in music. We have discussed already the stheneuphoric index. It means simply that we expend more energy in doing things which we enjoy doing than in those which are unpleasant to us. The practical importance of this matter is our excuse for its frequent mention.

Imagination is at once a most practicable and a most valuable educative process. Invention and scientific research would be unproductive

without it. One of the greatest pathologists of recent times, Paul Ehrlich, "discoverer" of Salvarsan, spoke of his chemical imagination as his "greatest asset." Here some of my readers may suggest to themselves that the use of the imagination leads to what has been once and forever abandoned out of science and education as the deductive method. But the use of the constructive imagination is not "deduction", not a fitting of science to belief or to dogma or to mere opinion, but is rather an elaborate case of the sound and biologic method of trial and error. In using scientifically one's imagination, constructing a theory, we first sees if it fits. If not, we must be willing to throw it aside frankly and promptly; the only danger lies in obstinacy. Examples are innumerable of the great productiveness of this common method of trial and error. The indispensable employment of imagination is shown in the planning of the Atlantic cable, the telegraph, the wireless, the telephone, the electric light, submarines; these and many others could not have come into existence without a preliminary activity of creative imagination. Theories, hypotheses, philosophies, are all impossible without it. Imagination is at once more

useful and more used than is commonly considered in educational theory. No knowledge can be made our very own without this creative process, often called "assimilation" to the contents of the mind. Summarizing, reviewing, and abstracting is a practical and mechanical process of using the constructive imagination. Better still in the process of using our memory to the best advantage is thought, thinking things over that we have just learned; there can be no true education without the essentials of this process, for it means self-reliance, independence, even manhood and womanhood. Thought over a study-topic tends, by association, to go beyond the original limits of the assignment as learned; and this is pure imagination. Thus it becomes the basis of initiative, of ingenuity, and of originality, of all true creation.

The *creation of diagrams and illustrations* is using the imagination to a great advantage; and the process is art in the making.

The constructive imagination may be aided in fact and consciously and deliberately developed by many proper means. In childhood it may be developed by the reading or hearing of fairy stories; "Swiss Family Robinson," and all such books;

later on by the reading of books as "The Fairy Land of Science," Thomson's "Wonder of Life," histories of discoveries, Sir Oliver Lodge's presidential address on continuity, the novels of Jules Verne and H. G. Wells; by talking with fanciful and imaginative persons; and often by an active process of deliberate revery.

Another mode by which the creative imagination may be developed is the enlargement of our vocabulary, our list of words and the habitual use of these idea-handles in writing. New terms lead to new associations. In general, as we shall see, the dictionary is not used nearly so much as it should be for easy learning; its disuse is largely due to muscular laziness, not to mental indifference.

The third kind of imagination which we mentioned was the *organic imagination*. This may be termed the influence of the mind over the body, *suggestion*, and this is a very familiar word to all nowadays. Suggestion and its similars are strong and important processes in education. Ordinarily our interests are unrealized and our best capabilities wholly unknown. Millions of indigent and neglected children are thus handicapped. The playgrounds, camps, and the like

develop this knowledge, or at least show how to do so. The basis of organic imagination is strictly a physiologic process, and I state each year with more and more emphasis, the result of much observation direct and otherwise, *that there is no assignable limit to the voluntary control of the body.* This matter may be extended to the intellectual subjects of education as well as to bodily education proper.

Ideas that are inherently meaningful in human reason; or that are massive, full of detail (for example, laboratory work and direct observation); or that are especially striking because of contrast-effects or from other conditions, exert the most suggestive influence and are thus the richest educationally and stimulate the imagination most. None the less, the use of the organic imagination is perhaps more hygienic and ethical than narrowly educative. But this, too, is education, how to be *well* and how to be *happy*. This invaluable part of learning, the organic imagination, however practically valuable, we must almost ignore here. But all the Why Worry books, and the New Thought, and Christian Science, all the mind-cures and some of the really scientific psycho-therapeutics, are applications of the

organizing of the organic imagination. This is emotional suggestion which is of much value to easy learning.[1]

[1] See G. V. N. Dearborn, "The Influence of Joy." Little, Brown, and Company. 1916.

CHAPTER IV

BOOKS AND THEIR EDUCATIVE USE

Many wise minds have written volumes and multitudes of wise essays on books and their use. For such learning we may refer directly to Bacon, Montaigne, Carlyle, Emerson, and the rest — at hand everywhere. But I wish to suggest, in connection with this matter of learning, that the choice of books, both of textbooks indirectly and of other kinds more directly, is a test, in itself, and a criterion in a way of our likelihood of becoming well educated — of our general educability. Nothing gets our range more quickly than our choice and use of books. Millionaires sometimes furnish the library of a new home with books bought by the linear shelf-yard and, next to their space, think most of their bindings. But, as they, perhaps, finally realize, there is no known subtle influence passing from an idea printed in a paragraph of a book to the subconscious mind of a near-by person how-

ever great may be his desire to learn, or however closely surrounded with such printed symbols of ideas he may be!

The transfer from the printed page to the cortex of the brain means long and continuous *labor*, years of it, unnumbered days and nights of it. There cannot be a rule for the actual study of all books. Some books require concentrated attention for their mastery, and some do not. Some call for thoughtful revery running along with their reading, and some demand concentrated attention to the books' ideas themselves, if the reader would become really learned.

The amount of time actually spent on some lessons in seventy-five classes in the University of Iowa has been reported by Professor Irving King ("School and Society", December 4, 1915). Of the 2567 students who answered the questions of the investigator about 61 per cent used one and a half hours or less on the particular lesson assignments from which the statistics were made. Eight per cent used one half hour or less, and 5 per cent three hours or more. If we may take these figures as average values (and they are the only available data at present and as far as they go surely wholly reliable) we can judge fairly well

for ourselves whether or not we are doing ourselves, our time, and our money justice in the effort we habitually put forth in reading or in studying lessons. If we are assigning ourselves lessons, we can judge roughly from these averages whether they are of average traditional length and properly used. The concentration of the attention is far more important to easy learning than is the length of its continuous application. Here in the most certain way is quality far more than quantity. Thus Professor King's statistics are more suggestive than really significant for any one student. In any one reported case it might have been that the student concentrated and learned not only faster but better (as we shall see shortly) than another who misused six-fold as much time. Still, this factor would seem to be averaged as much as the others and we need not suppose that it would harm the validity of the results. As a practical point they suggest that *one-and-a-half hours is plenty long enough for most students to spend on a lesson.* If either too little or too much this period is more likely the latter, according to modern physiologic ideas.

Despite the necessity of "keeping everlastingly

at it" if one would become really learned, and the consequent need of using time to the best advantage, (to the *really* best advantage) there is small profit or none at all in carrying books about in the pocket and in the school bag, as we see many people do, for reading on the steam cars, street cars, and in other public places. Of course in general this is pure affectation. Any one who does it out of a serious intention of making the most of his time is doing so on a real misunderstanding, for usually the time is far too much broken to allow any adequate learning-compensation for the loss of rest of the eyes and brain, and the loss of observation during travel, even though it be only downtown. Every man, woman, or child sitting across the aisle, every intelligent horse or dog in sight, is a "book" for study better, under such circumstances, than most bookbinders have ever put together. Therefore it is idle to try to get knowledge out of books in a haphazard way, in distracted periods, each lasting only a very short time. "One thing at a time and that done well," and in this case only with full attention! In general the time to read is when we are alone, at least in quiet, for then with economy we can really make the required

book-cortex translation and transfer, and let the cortical neurones rustle unafraid.

For our present purpose we may make two classes of books: textbooks and books which are usable in this way, and others.

Textbooks are for direct, detailed study; that is their purpose. A good textbook contains the important facts and principles and the greater part of the essential information of the subject on which it treats. A textbook, as compared with other books, is very concentrated mind food, while the other books are usually not concentrated.

Real familiarity with full and authoritative textbooks is the backbone of educational information and understanding. Textbooks are our "old reliable" means of learning. This can be scarcely too much emphasized in these days of many social lectures and of other fashionable modes of pretended learning. The intensive use of books is based upon the substantial, old-fashioned recitation, and as we shall see a student can be very successful in reciting to himself. Relatively few students adequately realize the importance in the learning-mill of competent textbooks properly used.

For practical purposes it is advisable to consider the essential dynamic relationship between the four obvious elements of the problem of learning from books by the intensive study of them. These four elements we may denote as follows: — (1) the adequate textbook itself. (2) The real desire to learn its facts and its wisdom. (3) The forced and attentive study under the requisite pressure, great or small. (4) The transfer to the brain, and the associative process of interweaving with the knowledge and the wisdom already there. Of course there is every grade of learning-effort. When the effort based on interest is at its strongest, the outlines and some details of a whole new subject may be fixed in the mind in a few weeks or even in a few days. That is to say, this may readily be accomplished by a person who *knows how to study*, how especially to control his muscles and so to force his voluntary attention along the desired and, therefore, the interesting line of work. Obviously we are back again to generalized skill, the universal personal control over at least the voluntary muscles. It is sometimes actually surprising to observe how much of a new subject an active, vigorous boy or girl or an eager, hurried man can learn in a short time.

This "cramming", I suspect, is done in schools even much more than most teachers realize. Many students everywhere almost entirely neglect study day by day and then by a dynamogenic spurt learn the whole subject, and sometimes adequately, and now and then even permanently, within a week or so, or even a few days. In order to accomplish this, they have to have this training-control of mind, which is really a training of the body. But a student who lacks this knowledge of how to study, how to steadily force his mind for repeated effective periods along hard, because definite, directions, cannot accomplish such intensive acquirement either soon or easily. Such students (and the great majority of learners are of this latter type) must first learn how to study in this way; or else use the ordinary traditional method for average students such as the average school everywhere provides!

Here we are considering the use of textbooks by a student who knows how to make the most of them. This dynamogenic process (the word's meaning is obvious) is a pleasure as well as a necessity, and is widely open to all. But few indeed realize that they possess this all-important power of rapid and easy learning from textbooks,

of transferring the textbooks almost bodily and in a short time and for good, into their minds by way of their brains. The organism, body and mind, has to be trained to it. On the other hand, we may soon train ourselves once for all simply by doing this: *Forcing the issue with all our might*, and by repetition making it a habit. This we may call the intensive use of books. Probably in the long run this is not very economical for the most of us, for "it takes a bit out" of us. It is not what we can do, but what we can do economically that interests us in education. It is important, however, to us all to know how much we *can* do in emergency; and to know the mechanism thereof in part at least: a new chapter in educational science as well as in psychology and physiology.

Professor W. B. Cannon and his associates in the laboratory of physiology of the Harvard Medical School have recently worked out further details of the relations of emotional excitement to energy-expense in a way useful for our present purpose of learning how to study. Doctor Cannon says: "The close relation between emotion and muscular action has long been perceived. As Sherrington has pointed out, Emotion 'moves'

us, hence the word itself. If developed in intensity, it impels toward vigorous movement. Every vigorous movement of the body . . . involves also the less noticeable coöperation of the viscera, especially of the circulatory and the respiratory. The extra demand made upon the muscles that move the frame involves a heightened action of the nutrient organs which supply to the muscles the material for their energy! The researches here reported have revealed a number of unsuspected ways in which muscular action is made more efficient because of emotional disturbances of the viscera. Every one of the visceral changes that have been noted — the cessation of processes in the alimentary canal (thus freeing the energy supply for other parts); the shifting of blood from the abdominal organs, whose activities are deferable, to the organs immediately essential to muscular exertion (the lungs, the heart, the central nervous system); the increased vigor of contraction of the heart; the quick abolition of the effects of muscular fatigue; the mobilizing of energy-giving sugar in the circulation; [an increased coagulability of the blood; and the dilation of the bronchioles, both demonstrated by Cannon] — every one of these visceral changes *is*

directly serviceable in making the organism more effective in the violent display of energy which fear or rage or pain involve."

Now this "forcing the issue" through a book in contest with one's natural inertia, not to say frankly and truly oftentimes with one's natural or abnormal laziness, also comes to be explained. This firm and warm and vigorous determination to learn as fast as possible undoubtedly employs, and gets its often perfect success from, just these same dynamogenic processes. The bodily changes here would be less conspicuous than in acute rage or fear, but no psychologist can doubt that just the same they are also in action. (The same is true in other cases, notably worry, only that here fear acts to depress, as is its wont, rather than to stimulate.)

This "learning against time" has been studied carefully by Doctor G. C. Myers of the Brooklyn Training School for Teachers. The work tested was the learning of a list of unrelated words; twenty-six normal-school girls were given the task, thirteen having all the time they wished to use and thirteen being required to do the "stunt" in nine minutes. "Ten of the twenty-four," says Professor Myers, "made perfect records, and

the imperfect records were, on the whole, about as good as those of the first group. This means that when the subjects knew they had only a limited time in which to do the task, almost half made perfect records in the time in which a perfect record was made by one of the first group, working without a time-limit. Furthermore, one does not know how many of the ten could have done the task in a shorter time than the nine minutes given. In addition, these ten out of twenty-four made perfect records in five minutes less time than the average time required by the nine who made perfect records in the first test. Moreover, the second group, though belonging to the same class, was a little inferior to the first in scholastic averages." These results by themselves certainly make out a strong argument — everywhere in general corroborated by experience — for the advantage of intensive effort in learning and in doing.

Professor Woodworth, of Columbia University summarized this question as follows:[1] —

"The contradictory results obtained according as retention is measured by the saving in re-learning or by the amount recalled make it desirable to introduce

[1] A paper read before the American Psychological Association in December, 1913.

further variations into the study of the above question. One variation consists in avoiding the matter of individual differences, and examining the learning and retention of *single associations* by the same individual. In one of the experiments reported, an Italian-English vocabulary of twenty pairs of words was to be learned from auditory presentation. After one reading, the experimenter gave the Italian words as stimuli, allowing three to five seconds for each response, prompting and correcting, and so continuing till each correct response had been given once. Overlearning was avoided by dropping each pair from the list as soon as it was learned; but after all the responses had been correctly given, the experimenter read the whole list through once more. After an interval of two to twenty hours, the experimenter again used the Italian words as stimuli, and got the score of correct responses, and also a report of associative aids employed in remembering any of the pairs.

"Under these conditions, the more quickly learned pairs were the better retained. Thus:

Of the pairs learned in 1 reading, 73 per cent were recalled after the interval.

Of the pairs learned in 2 readings, 72 per cent were recalled after the interval.

Of the pairs learned in 3 readings, 63 per cent were recalled after the interval.

Of the pairs learned in 4 readings, 58 per cent were recalled after the interval.

Of the pairs learned in 5 readings, 38 per cent were recalled after the interval.

Of the pairs learned in 6–11 readings, 27 per cent were recalled after the interval.

"Since the aided pairs (pairs in which the subject saw some relation between the terms or developed some mnemonic to hold them together) were both more quickly learned and better retained than the unaided pairs, the advantage of quick learning probably lies partly in this association with aids. But this is not the whole story, for when the unaided pairs are considered by themselves, the quickly learned among them are better retained than the slowly learned; and, indeed, the quickness or slowness of learning makes more difference to retention where no aids are present than where they are present. *We conclude that quick learning favors retention*, and aided learning favors retention each independently; but that the two influences work together, inasmuch as the best aids suggest themselves promptly and promote quick learning."

But does this speed conduce also to retention as well as to time-saving and to mind-training? In other words, is work so done remembered? Apparently it is, for this matter of the rapidity of learning in relation to the retention of the matter learned, Professor W. H. Pyle of the University of Missouri has studied accurately. His summary of the results reads: "Twelve subjects were tested for their rate of learning a passage of easy prose, and for their retention of the passage after a lapse of twenty-four hours. The most rapid learners showed the highest percentage of retention."

Here again we are reminded, and forcibly, of the great importance, for economical learning, of *expending much energy for short periods at a time.* This matter can scarcely be too often emphasized as a practical point for easy learning.

Note-taking is just as essential in either the intensive or the extensive use of books as in taking lectures, if we would do our learning both well and economically. The process required is something like this: — Abstract each paragraph or topic after reading it carefully through twice, and write the gist of the abstract, in your own words so far as possible. Only the use of our own words will show that we really have abstracted the meaning, and that we appreciate the sense sufficiently well to be able to write it concisely out of our inner understanding. If, on the other hand, we make our abstract of a paragraph or a topic in words before us, in those of the book, it will be apt to degenerate practically into a process of copying, at least to some degree.

After a little more experience, the motor note-taking, that is that on paper, will be discontinued by most of us for we shall soon have discovered that the mental part of the process of taking notes has been transferred to our reading

habit. In other words, after a little experience of this practice we shall find ourselves studying and *reading by the abstracting and note-taking method*, but without writing the notes save in our figurative sense of inscribing them on the productive and constructive tablets of our brain. If we try along this line we shall soon learn to think (*i.e.*, abstract and extend) and read at the same time. Note-abstracting and integrating each paragraph or chapter or topic in the book is, then, a very fundamental thing indeed, because in this way we symbolically impress on our brains the gist of the matter in another part of the brain and also in a wholly different manner.

Another highly important and often neglected practical practice (especially for young students) is *the systematic use of a dictionary* "alongside" the book which they are reading. The very general neglect of the dictionary is one of the chief defects of present-day learning methods, in literature and in science, especially. This strange neglect is the cause, first, of the surprisingly small diction or vocabulary of which so very many educators are everywhere complaining. In the second place, it is in part the cause of the lack of power to use good English. In the third place,

it is partly the cause of the lack of the thinking-habit, because it means a lack of associative material for the mind's use. If we really wish to develop these three large and basal fractions of an education, a good vocabulary, a good use of language, and a good thinking-habit, we shall cultivate intimacy with dictionaries, years on end. As we read, *we should keep a list of the words encountered which are not familiar, and effectively familiar, to be looked for and investigated in the dictionary.* The knowledge and mental breadth thus acquired are rapidly accumulative and bear interest of valuable intelligence compounded not only semi-annually but every night while one is asleep. Doctor A. A. Berle has expressed it well in his timely and suggestive "Teaching in the Home." [1]

"Now it must be reasonably clear that if books are to be used in the later education, the first thing to do is to get the ability to read them. Therefore the child-training will see to it that wherever a choice is possible the choice will fall upon the word which will be used in books, rather than in colloquial assemblies. I think I have said elsewhere that half the children in our high schools cannot read their textbooks, and this is undoubtedly true. Through our entire grade system we

[1] Moffatt, Yard, & Company, New York, 1915.

stick to the colloquial habit when we should be making the book habit. But it should be made even before that, namely in the home. At first sight, this seems like making the home conversation stiff, and void of the vivacity which is said to be the chief charm of non-bookish talk. But my observation and experience lead me to think that exactly the reverse is true. No conversation is so bright, so sparkling, or so enjoyable, as that which uses words with precision and enables the thought to play swiftly and with discrimination upon the fine shadows of meaning. Nothing enables one to use quotations with such telling effect. Nothing moves the mind to greater expertness or appreciation. One reason why an older generation had so much purer speech than ours seems to have, was because the fine old habit of reading aloud prevailed then, which introduced the reading vocabulary into the area of common conversation. Children heard their elders use not only pure speech but the dialect of knowledge. They gained from hearing poetry and fiction and sermons and classic literature, read at the family fireside, a great instrument of comparison which was a thought-builder, second to nothing.

"Obviously, then, intensive training must think first and foremost and all the time of English, and that not merely the pure English of popular speech, but *the English of books.*"

The next few years will certainly develop much advance along just this line of educational and psychologic wisdom. This is the road to true, conceptual-efficient education, to the essential

habit of productive self-reliant *thought.* The place for the student to begin this dictionary-use is in his textbooks.

The relation of ample diction (a large knowledge and ready use of very many words), *of thought, and of intelligence* is so close — these three-in-one are so wholly interdependent, that again, for double emphasis, it is suggested that *the continual use of the dictionary, especially of an ample dictionary of synonyms and antonyms, is among all modes of educational "bother" among the most essential, because directly the most productive,* especially for the young. It is most unfortunate that our grade-system does not include a deliberate study of the English word-books, since every new word really learned is a new concept and in general the ever-breeding germ of a new set of interwoven ideas — relating and interknitting without end, save as the cortical neurones cease their associations and grow cold.

As a point of practice the possession and use of printing outfits by young people between eight and eighteen is of very great educative value and for several obvious reasons. (1) This kind of play-work-study teaches orderliness automatically, for a disorderly printing shop, one in a general *pi,*

so to say, like the mind itself, is self-destructive. (2) It teaches the nature and choice of words, giving the student an intensive knowledge, a "massive" conception of those, at least, which he sets up laboriously in his composing stick, adjusts in the form, and distributes again into their compartments. (3) Printing teaches punctuation (just now, unfortunately, to some extent out of fashion) and more quickly than any other method. (4) Hand-press work is an ideal form of mechanics for inculcating close observation, delicate visual and kinesthetic discrimination by eye and hand and finger. A good hand-printing press is a fairly complex instrument, built and operated on fundamental laws of physics, and if the student learns to do fine work, it rapidly develops the most careless and heedless into a person of fine discrimination of touch and kinesthesia and sight. (5) Composition of forms of type in ordinary, varied, job-work teaches the new printer that sense of harmony and proportion, of emphasis, logical and perceptual, and taste in general which are at the very basis of our modern literary work, particularly in its more practical and commercial phases. (6) Printing teaches patience and cleanliness, as well as industry and the

principles of conducting a business. (7) This art, at once play, work, and study, is oftentimes the start of a life-long interest in the publishing business or in engraving. At any rate, if practiced adequately, it gives a boy or a girl a trade or even a craft which anywhere might earn him a livelihood at least. (8) Printing gives a taste and an appreciation of a well-made book. (9) Newspaper editors have been developed before this by the production of toy journals. Twenty or thirty fonts of small and varied type and a good hand-press, printing say 5×7 inches, may be considered, educationally, to be as good an investment for a hundred dollars as can be had; thirty dollars will accomplish the principles of the same results.

We should have as large a variety of textbooks as it is possible for us to possess. This is an investment, rather than an expense; it means an income, not an intellectual or a financial deficit. Most of these *textbooks should be kept.* They are, in a sense, an important part of our minds. If we would insist on a definite, desirable number of textbooks to be owned, the number may be set at three on every subject. This number will give us a considerable variety of points of view on

the same branch of learning or the same sciences, and make for wisdom as well as for knowledge.

Furthermore, we should have as much as is expedient of *collateral reading*, if we wish to get all we can out of our textbooks. This adds interest and many details, and makes particularly for breadth of mind in the subject which we are studying.

For purposes of completeness, and even of comparison with the principles of the present book, it may be useful to have before us also a summary of the ideas of an earlier writer on how to study, Professor F. M. McMurry, of Columbia University, as made by Professor J. E. W. Wallin, of St. Louis. He writes: —

"McMurry finds eight requisites of economic study. (1) The child must at the very outset feel a definite, specific purpose or need in his study — not the vague, general aim to acquire knowledge, culture, efficiency, power or skill, but some specific problem in the lesson assigned. This will supply a vital interest to energize effort, focalize and sustain attention; it will transform knowledge-getting from a mere collecting of facts at random to a discriminating choice of data relevant to the specific aim; and it will divert knowl-

edge into practical channels. (2) Pupils should be taught to organize their reading matter around these leading points, and to subordinate the supporting data in the order of value. This involves keeping the central thoughts clearly in mind, the rapid gleaning or neglect of the unessential details, and the observance of a certain procedure in teaching. (3) Since the text must treat topics fragmentarily, require the child to reconstruct and supplement the text-book treatment by his own ideas and experiences. This requires the use of developmental instruction, texts with abundant details, emphasis on reflection as against verbal repetition, and versatility in methods of reproduction. (4) Children should be encouraged to assume a critical attitude toward what they read, and to pass independent judgments upon the credibility of the statements in print, owing to the fact that the latter are often exaggerated, one-sided, inadequate or false. (5) They should likewise assume an unprejudiced, tentative attitude toward knowledge, because many of our conclusions are possibilities or probabilities rather than established certainties, because our attitudes are so prone to become dogmatic and ultra-conservative, and because children incline to base

their opinions on authority rather than reason. (6) Studying also involves memorizing, but its importance has been grossly exaggerated in past educational practice and theory. It has been made the pack horse of education, becoming practically synonymous with studying, so that children have rebelled against the intolerable drudgery of school life. The drill likewise has usurped too much attention, and has been a prolific cause of educational waste, stultifying instead of nourishing the child. This chapter, in contrast with the others, is destructive rather than constructive in tendency. (7) Children should be obliged to apply the information gained through study, since use or adaptation to environment is the end-point of ideas, of the capacities and abilities of animals and men, of the subject-matter of any branch of study whatsoever, and of all education. This is the goal of ideas as well as ideas, and can be realized not only in manual and constructive execution but also in skillful talking about the subject-matter. (8) Lastly, there should be ample provision for individuality in study." (These are the most desirably explicit directions for scientific economical learning which have been published up to the present time.)

A few words regarding books other than text-books, and especially as to their use, may be added properly in this connection, since oftentimes these are important factors in our easy learning. They lend breadth to our education as nothing else can do. Some books, for example, written for popular sale, have much basal science and philosophy in them because they are often summaries of many other far more fundamental treatises. Most of them are fragmentary, however, rather than really integrative, their material being chosen on other than a scientific basis by some more or less incompetent person. The reading or at least the acquaintance with the range and the main theses of numerous current and older books on subjects allied to that being studied, is in general quite necessary in order that a student may be accurately and wisely *oriented* and remain so. A thinker without many books well read is apt to become a pedant and a crank, just as a bookworm without thought is an encyclopedia and not a man or woman at all, — a passive, useful vegetable at most.

Many hard and serious students and scholars, especially adults, read evenings, or even at other times, purely for recreation; and many high-school

and college students find time for much reading not directly related to their curriculum. In the early part of 1916 Professor J. Carleton Bell of Brooklyn and Itasca B. Swett of the University of Texas, reported the results of an investigation which they had made into the reading interests of the high-school students of Austin, 440 of them: —

"With the girls, light fiction forms the largest part of voluntary reading. The general tendency is for this to decrease during the high-school period, but a decided fall in the low tenth grade is followed by a rise in the high tenth and low eleventh. With the boys, books of adventure take the high place occupied by light fiction with the girls. On the other hand, books of adventure with the girls drop to practically the same position as that held by light fiction with the boys. . . . The interest in standard fiction increases with both boys and girls as we go upward through the grades. The short story does not hold so high a place as might be expected either with boys or girls. Its position remains fairly constant through the grades. With the boys, children's books take about equal rank with short stories. With the girls they are much more popular. Their popularity with the girls increases as we advance in the grades, while with the boys it remains about stationary. Biography and essays show a slight increase in popularity with both boys and girls, but they don't take a high rank at any time."

History, science, and fairy stories were found to be so little read that their variations were not put into the graphic form. In general, *plot* provides the maximum interest for both girls and boys — a matter that brain-tired adults numerously and joyously will confirm. These results may be used as norms for the general reading guidance of young people.

Books after all are only tools; private books are seldom worn out; and second-hand books are of little sale-value, usually "fetching" only about ten per cent of their original retail cost, even when not far from new. For these reasons and others *we should not affectedly make fetishes of our books, but rather use them for all they* (*and we*) *are worth.* It is a lot better to "break the back" of a book than to be long bothered in using it by its improper and inconvenient binding. It is far better to harm it commercially by writing notes on its margins, than to miss the value of these notes in our learning minds. We should buy good editions if we can afford them, but if not, cheap editions. The difference in the print, paper, and the like, if the reading-light be good, nowadays is not of relative importance for the simple reason that now type and paper are much cheaper and

therefore better, and that more reprints are made than in former times.

Most work with books should be done in the daytime, for usually the nighttime is for recreation and for sleep. We frequently see a student try to read (as well as to sleep) with a strong light shining directly or indirectly into his eyes. This matter is of great importance, because a strong light shining directly into the eyes irritates the brain, as well as the eyes themselves. The forenoon is the best time for the best book work, (that which is original and intensive) but the quiet early night is a good time also. It is well always to insist on a good light behind the reader and not in front, unless the eyes be shaded by some-kind of really opaque shade — the usual translucent or transparent green shade is not opaque. A direct, unshaded electric light is too bright for most eyes. A good kerosene lamp or two gas flames (a naked flame and a mantle-flame mixed) is much better than direct electricity; strong electric light reflected from the ceiling is ideal, but in most cases such light is not sufficiently intense for easy reading.

A note-book should be near by, "handy", in all reading, provided we wish really to learn the

book, and learn it economically. We should read the preface; and usually the introduction of a book (however contrary this advice may be to common habit), because the preface and the introduction together usually *orient* us, set us going aright, and will satisfy that curiosity which otherwise is sure to be aroused during the reading of the book. If our impatience positively cannot be withstood, do by all means look a second or two at the last chapter, so that curiosity may not disturb the mind any further. We should always look over the table of contents, if not the necessary index, so that we may know at all times about where we are in the book. Then, too, we shall know better what, if anything, to "skim", and of what to lay permanent hold. In general, we should be warned against skimming a book unless we are certain in advance that the book really deserves to be skimmed. This is essentially a habit of inattention; but, on the other hand, sometimes our attention can be used just in this way to the best advantage, *provided we acquire the habit of picking out rapidly, as we skim, the real essence of a page.* This procedure is allied to the process of abstracting, already considered. Certainly much time is wasted in the slow reading

of every word of certain books; there are books and books.

Remember that a book intends, most often at least, to represent some sort of a set of *ideas.* We should take this for granted anyhow, and *make it our sole business as a student in reading the book to pick out these vital ideas.* Since this essentially means comprehension, it is not surprisingly easy; yet it must be done, since nothing pedagogic will replace practice and careful training in this important matter. The young student at first reads or studies a book, equally, from the beginning to the end, putting the same amount of time and effort on each page. But the mind never works that way, outside of books! As we walked down the street yesterday looking in the attractive windows our minds did not spend so much time on some things along the way as on others; at camp, last summer, certain salient points made up our particular mental day, and no other camper's day as an unit was just like ours; each one's experience is unique; life is different for each human soul. Our mind's associations, our needs, our interests, and so on, should *select* what for us are the most salient points. Thus it is in reading. Francis Bacon

familiarly says, "Some books are to be tasted, others to be swallowed, and some few to be digested", and more and more, with the ever-swelling and boundless tide of published books, is this old dictum appropriate. We each buy a copy of the same elaborate book, printed from precisely the same types, yet your book is never like my book! It *means* more or less or differently to you than it means to me; and its meanings for its readers are itself. Your books are not my books, although they be materially identical. They are not the same simply because your mind is unlike mine. Thus it is that in every book there are many books for many minds. We should *try always to get ours out* of every book we read. We should learn in reading and studying to pick our own individual "book" out of a volume. In other words, we should learn to note the part that is for ourselves, and learn not to waste time on those parts of a book that are not for us, whether because familiar or incongruous.

Learn to read a book without reading *on the average* more than a quarter of it! Learn to get the meat out! With the enormous number of books that are of real importance, no other method in truth is feasible; for economical learning

nothing in the long run is more essential than this, the *intensive*, method. Learn to abstract, learn (as reviewers have to do) really to become familiar with the most of a book without undue loss of time! In my reviewing work, I learn the gist of many new and variously difficult books in the course of a year, but (save exciting detective stories or novels) I read every word of scarcely half a dozen. The training-road to this goal is abstracting a paragraph by a sentence and then a chapter by a page of notes and so on to the end. We should be careful not to write into our notes of a book our own ideas which have been suggested to us by the reading; this is a common bad habit of young students.

A few words as to *periodical literature*. To-day learning is slow and old-fashioned which does not include at least a few of the special technical magazines. Elementary study requires these as collateral reading; and advanced study requires them for advanced information and for integration, and to relate to ourselves the status of public opinion and taste.

The importance of *bibliographies* to students can scarcely be overestimated, because the knowledge of the name and title of a volume or of an article

is often the next-best thing to its actual possession. Knowledge of the available libraries is essential, and the proper way of using them is wholly necessary to the really progressive student. Next to really knowing a good book, is to know, first, that it exists, second where, and third, — very often this is enough!

All these factors of book-use count not only in themselves, but also as indirect means of keeping the less conscious parts of the mind on its task of arranging and pushing your scholastic work.

CHAPTER V

IS YOUR "THINKER" IN ORDER?

THE ordinary supposition among educators as well as among the business-men of the world is that the "thinker" of the average student is *not* in order. This, we all "take" it, is one of the deepest of the objections to the present educational system — that it does not teach students to think for themselves. A truly educated man knows how to think, and, moreover, he has the process habituated and, therefore, in easy action. It is said with truth that the present school system does not educate as yet in this sense at all. As a school-boy said to Sir Gilbert Parker, "I am sick of information; I'd like to think a bit, but I haven't time. It's stuff me with things I learn to-day and forget to-morrow." Compare with this remark of a gamin in London that of Professor John Dewey, of Columbia University: —

"Any examination of the prevailing modes of

instruction will show that the mere bulk of matter communicated in books and lectures tends to swamp the native and active interests operative in intelligent behavior and in the acquaintanceship it brings. There this matter remains unassimilated, unorganized, not really understood. It stands on a dead level, hostile to the selective arrangement characteristic of thinking."

These quotations express the opinion of all "thoughtful" students, and this condition is the same in the school systems of the whole world. A dictionary has facts and aplenty, but only man has thoughtful reason.

Read Emerson on "Self-Reliance", —

"To believe your own thought, to believe that what is true for you in your private heart is true for all men, — that is genius. Speak your latent conviction, and it shall be the universal sense; for the inmost in due time becomes the outmost, and our first thought is rendered back to us by the trumpets of the Last Judgment. Familiar as the voice of the mind is to each, the highest merit we ascribe to Moses, Plato, and Milton is that they set at naught books and traditions, and spoke not what men but what *they* thought. A man should learn to detect and watch that gleam of light which flashes across his mind from within more than the lustre of the firmament of bards and sages. Yet he dismisses without notice his thought, because it is his.

In every work of genius we recognize our own rejected thoughts; they come back to us with a certain alienated Majesty. Great works of art have no more affecting lesson for us than this. They teach us to abide by our spontaneous impression with good-humored inflexibility then most when the whole cry of voices is on the other side. Else to-morrow a stranger will say with masterly good sense precisely what we have thought and felt all the time, and we shall be forced to take with shame our own opinion from another."

The reform of the school system in this respect, that annual $800,000,000 system, is a matter of many years, but an individual may reform himself in this regard in a few weeks. He may learn to think, and "learn himself" more or less in this manner, indeed, he may keep his "thinker" in order: —

Every one of us has some kind of a "thinker," for no really feeble-minded person, probably, is reading this advice, and certainly no idiots — these last by definition have no "thinkers." In some cases our "thinkers" may be said to be atonic and small, and not of much use now. But they may be developed if we *will* to develop them. (These are the "thinkers" of the relatively stupid people.)

In some cases our "thinkers" are well de-

veloped, but rusty and creaky and dried out; these need a thorough cleaning and oiling and vigorous *use.* (These are the lazy students.)

In some cases the "thinkers" have parts which are likely to break down at any moment. (These are the illogical minds and the guessers.)

In some (in most) cases our "thinkers" are normal, but have the uncertain and difficult action of *newness;* they are not used nearly enough to make them run smoothly; they should be cleaned with determination first of all, then oiled with intelligence and energy. (These are the average minds.)

To adopt a more biological metaphor, unused "thinkers", like all the other organs, tend to atrophy, and fibrosis or sclerosis is the neglectful result of inadequate action. On the other hand, it is as delightful as it is useful to take systematic exercise and so to become a strong or perhaps even an intellectual athlete. But how few of the vast, hurrying, heedless throng of adolescents and of men and women can be made effectively to realize this! Yet the process, as well as the product, is a continual delight, and it is the most *essential* process in the mind's whole action. The factors of education are more numerous than

many suppose, and each one requires thought and teaches thought: — the home, the schools, books, our associates, our vocation, the stage, travel, the state, the church — learning is a process of reaction to each of these. All nine factors contribute material for learning which is valuable more or less in proportion to the thoughtfulness and activity with which it is allowed to act on the learning mind. Learning is a process of *activity* of personality, and develops in quality and quantity in proportion equally to the individual's inherent fitness and to the richness of his effective environment. Thought *is* this reaction or a part of it. This is an active receptivity; it is like the heat coming from a fire arising from oxygen and fuel — it is inevitable. Thought stands for INITIATIVE based on understanding and originality.

Girl- and women-readers must realize that this thinking process is less *explicit* and conscious in their minds in proportion as they are really feminine. The feminine mind "jumps at conclusions", has *intuitions,* as we say. *Intuition* has important educational bearings in the direction of economy and easy "learning."

If we may trust for educational purposes our

general experience and the common and wide experience of numerous life observers who write fiction, there is now no acceptable reason for denying that this popular concept, intuition, is live and real, and worthy, therefore, of at least a brief scientific discussion. Some bolder psychologists and educators, certain of the vast educational importance of "the subconscious", the subsensory aspects of mind, go further and maintain that intuition is more characteristically feminine than masculine.

In general, it is one of the silent mysteries of mind why psychology does not more rapidly study the tertiary sexual characteristics. It is possible that some would maintain that this bottomless crevasse of sex, which so completely divides the entire living world into two opposite yet complementary halves, does not extend into the peaceful animistic realm of mind. For my part, however, I do not believe it, for I see, unless my vision be in vain, a forbiddingly large fraction removed from the human nature which we psychologists crave to understand were sexual mental differences smoothed out by some titanic and inchoate "drive" of some futuristic suffragism, omnimilitant in its powers. At any rate our

present contention is that feminine intuition is a fact in need of study as an aid in economical learning.

In the briefest possible terms, too concise, indeed, to be thoroughly scientific, it seems that intuition perhaps has as its inherent character a fourfold nature — (1) A delicate and ill-realized affect or feeling-tone anent the intuited situation; (2) a more or less accurate process of comparison and inference, usually not at all consciously appreciated; (3) an understanding of the causal situation, often with much acuteness and with far-reaching wisdom. And (4) an effective instinct to trust the impression thus presented in the mind, the instinct in the adult already being long habitual.

At the base then of intuition stands solid and strong the appreciation of motivity, an interpretation of human purpose, an habitual and therefore automatic tendency to put ourselves in another's place, to make his problems as much our very own as if they were so. Oftentimes, of course, the situation involves the motivation of numerous persons, not alone of one, or an immediate comprehension even of a whole "social consciousness" itself. The educational quintes-

sence of the intuitional process seems to be most always an appreciation of motivity, of cause, but more typically when in others than when in ourselves.

Accepting Professor H. C. Warren's factors of purposiveness (forethought or anticipation, assent, potency-feeling, the self-notion, and the sense of fitness) as adequate and keen, we may claim that intuition involves the appreciation by the intuiter of the potential purposive activity of the intuitee (if we may for convenience use such terms), the very essence of which activity is given to the former in ill-appreciated but none the less real adaptive, that is kinesthetic, terms — the index again of motor skill. The intuiter feels, in short, the action, the behavior which the other's attitude toward his environment properly demands on her part; and she takes it (subconsciously) for granted (on an hereditary-experience basis) that the natural behavior will occur — as, barring caprice, it will. Women, no more than men, have clairvoyant powers (so far as science is sure) on any basis other than that of their own personal or inherited experience. This experience seems to be adaptive, that is for psychology, predominantly kinesthetic and motor.

This kinesthetic motor criterion on which a person may intuitively grasp an "ejective" (personal) situation would seem to account for the emotional tone in the recognition, and still more surely for the understanding of its personal nature — two of our four suggested intuitional factors. It may be properly supposed not to account for the third factor, an ill-appreciated process of reasoning. The fourth factor, the habit of confidence in the intuitive process, does not, likewise, need further explanation; however important, it is like habituation elsewhere.

But it is worth noting for educative purposes, that the entire intuitional affair, save for its product, is one of the highest possible intelligence and at the same time typically subconscious. Certainly by the fostering of its elementary components — sense-discrimination, comparison, the simple feelings, understanding, the habit of listening to one's over-soul, as Emerson terms it — intuition is liable to development much to the aid of life-efficiency; it is a possible element of training for easy learning.

Intuition, then, and the comprehension of a total situation of whatsoever sort involving motive, which intuition implies, is in a way and

in a degree a real criterion of real intelligence in its most significant values. From this deep way of looking at the matter, the feminine mind is more evolved, more intelligent, in short, than is the mind of the male. Obtuseness stands for relative lowness of human-grade or for abnormality; intuition for a high degree of that which mind is especially meant to serve — the safeguarding and the furtherance of the individual. From such considerations it would appear that intuition deserves far more study and consideration than thus far has been accorded to it by educational psychologists. It should be studied in the grade schools as a class experiment, and in the psychological laboratories as a topic fertile in substantial product.

Incidentally it should rejoice every schoolboy in the Land and Everyman that the biologic source of our very being, womanhood, undoubtedly is the richer of the two sexes in this intuition, this useful criterion of our common human yet always divine intelligence. Is not this richness a measure in a way of woman's superior intelligence? Women and girls relatively do not reason in the bald cold method of comparison, but their intellect "gets there just the same",

often better indeed than that of man with his technical but mechanistic reason. For logic is only a thin and cold echo of the deep voice of the rich human intellect. Women have always instinctively trusted to the products of the subconscious thought in their souls. So have philosophers of the highest rank, for example Emerson.[1]

A recent example of the latter class is Henri Poincaré, recently dead, a great discoverer in mathematics, an astronomer, a well known writer and thinker in philosophy. An editorial in a medical journal [2] discusses at some length his use of thought in the subconscious mind, in part as follows: —

"The question how so great a mind works is extremely interesting. Poincaré has told the story of how he reached his great discovery of the Fuchsian functions. It was not reached all at once, but by several steps. The first and most important development came to him one evening when, contrary to his custom, having taken a cup of black coffee at dinner, he could not sleep and the idea of this new mathematical mode took form little by little under these unusual circumstances. The problems which were involved came clearly before his mind and seemed too difficult for solution; so gradually

[1] The author has further suggested the nature of intuition in an article in the *Psychological Review*, XXIII, 6, 1916.

[2] *Journal Am. Medical Assoc.*, LIX, 18, 2 Nov., 1912.

he put them away and succeeded in falling asleep. The successive steps of the solution came to him subsequently, not as the result of deliberate study of the problems, but long afterwards and under most diverse circumstances, at moments when he was not thinking about them. They came to him as flashes of light, almost inspirations, as it were, — once when he was just about to put his foot on the step of an omnibus, again when he was crossing a boulevard, a third time in the midst of a geologic excursion with some friends, when the conversation was about ordinary subjects and had no relation at all to mathematics.

"Ordinarily mathematics at least is supposed to be eminently intellectual and its developments are connected by the most rigid logic. It might be expected, then, that it would be only in the midst of deep thinking, even absorption of mind in mathematical subjects, that great new ideas would come; but Poincaré believed that it was a subconscious mind that solved the problems. His explanation of this, which resembles that so often heard with regard to the inspiration of the poet or the musician, is that certain thoughts are passing through the unconscious mind all the time, and that, as in day-dreaming, we are never without groups of thoughts. Whenever one of these thoughts proves to be a particularly beautiful or strikingly novel conception of some kind it attracts the attention of the conscious mind and then is retained. According to Poincaré's experience, then, like poetry and music, the sciences, including mathematics, owe their development not to the rational conscious mind so much as to the unconscious and involuntary faculties. There would seem to be a tireless force in man, a part of him

and yet not a part of him, working, thinking, developing, which brings to the conscious entity, man, his best thoughts and discoveries. Poincaré, for all his genius, was a sane and simple father of a family; he himself taught his four children."

This is an example of subconscious thought in the constructive process which we have discussed in our third chapter as the constructive imagination. "*Stop, look, and listen!*" *to your own minds.* This is one secret of learning to think — one which women, heaven bless 'em, have known instinctively all along. Set your subconscious "thinker" going by deliberate, fixed, permanent intention, and then *listen!* Encourage it now and then by actively giving it full opportunity. Let us stop the over-stuffing of our minds, and thus give them every possible opportunity to work. We feed a furnace with coal to get heat from it, but some schools and some individual minds are forever putting facts into the mind but never providing place or time to use them. If thought be "the loved one" (as it might well become by association) the familiar quotation is very apt, much to the discredit of our present educational system: — "Never the time and the place and the loved one altogether!"

The nature of thought should receive brief attention. Thought is not revery, musing, fancy, day-dreaming, although most *so-called* thought is just this, a loose associated train of ideas or notions or fancies. True thought is intimately of the nature of the human reason; is more precious, more productive, "sterner stuff" than a more or less passive revery, for it involves the expenditure of force, as the psychological essence of humanity well might do. The most important element of thought is reasoning, although recall, association, and other processes are of value too. In principle, reasoning is extremely simple: it is but a *comparison of things and then an inference from the comparison*, what Lloyd Morgan has strikingly called "thinking the therefore." Thought, then, consists of two judgments; a comparison, and an inference.

We might perhaps develop somewhat the capability of intensive thinking by actual practice in these several mental processes. Since thought as a series of efforts (we are not discussing revery, which often certainly masquerades even in good company, under the better-sounding name of thought) consists of two deliberate (although perhaps subconscious) judgments, their

careful discrimination, and then their comparison, with the essential, extraneous, mental process we term *inference* following, it is not unlikely that thinking of the more logical and mechanically productive kind would be furthered by *the deliberate development of these intellectual powers separately.* (1) In practice we might train and develop our power of judgment by making many carefully considered and delicate judgments on all kinds of propositions, thus laying a firm basis for the more productive forms of mental action. (2) We might, too, even by work as subject of experimentation in a psychological laboratory or by practice and effort in many other kinds of place, develop and train our sense-discrimination. Indeed this is a neglected important function of the elementary school, as we have already emphasized, that training of the senses, the power of delicate discrimination, the only basis of accurate judgment and comparison, which last is in turn the fundamental process of the intellect. (3) Development and training of the power of keen and novel inference is not so easily suggested as a practical practice-procedure, for we know little about it save in the most general terms: — that inference is a process of judgment

based on a largely subconscious process of the association of ideas, the very essence of human mental activity in its ideational aspect. Obviously, inference is an advanced and more or less "neural" form of association within or between the neurones in the parts of the brain-cortex which are devoted to thought. We may at least suppose that if the preliminary processes be developed and made vigorous and habitual, the inferences would result more frequently and more usefully, leading to novel and so to more productive thought.

Learning and all mentation are related to that form of personal ability which we have denoted as skill. The judgment of comparison is, then, one of the basal mental processes at the bottom of all thinking that is properly so called. The following research [1] by the writer, on the discernment of likeness, is a simple discussion of the processes which subtend rational thought in the thinker's mind and brain.

[1] *Journal of Philosophy, Psychology, and Scientific Methods.* February third, 1910. The volume "Kinesthesia" in Moffatt, Yard, & Co.'s "Our Senses and What They Mean to Us" Series, 1917–18, ten volumes, will set forth the philosophy of skill and of ability in general.

The Discernment of Likeness and of Unlikeness

In particular the research aimed to help the analysis of the mental process by which we become aware of similarity and of dissimilarity. Its method is experimental and it reports the simplified laboratory-judgments as to the likeness and unlikeness experienced in the case of a series of visual forms. The experiments of the work were performed in the psychological laboratories of Columbia and of Harvard universities. The simple-enough apparatus employed consisted of the *blots of ink* previously described. From about five hundred of these largely chance ink-blots made on paper 4 cm. square and mounted on thick pasteboard of like size, one hundred were taken as they chanced to lie in a box, that is, quite at random. The backs of the blot-cards were numbered consecutively from one to one hundred for ready identification. Besides these, four other ink-blots were selected to constitute the norms with which the others were to be compared as to their respective likeness or unlikeness. A wire frame to hold fixed the norm-blot convenient to

the subject's vision and a table on which the century of blot-cards could be arranged ten-square in numerical order completed the apparatus employed.

The subjects employed in this research were twenty in number; two were philosophical professors, one an instructor, and two assistants in psychology, while the rest, with one exception, were students in the two laboratories where the experiments were performed, the exception noted being a college graduate. The subjects were all males ranging in age between twenty and forty-three. The chief interest and work of one of the subjects lay in the art of music — a circumstance whose influence will be noted later on. The interests of the others were certainly sufficiently varied to prevent the occurrence of bias in any direction in their subjective reports, no one avowing or evincing any particular prejudice as regards the nature of the processes under inquiry. All the subjects employed were sufficiently familiar with psychological analysis to afford both their introspection and their subjective reports the requisite accuracy. Here, as nearly always, however, the chief stress was laid on actual reactions rather than on more or less uncertain and

ambiguous mental images and ideas, on the principle that bodily reactions express better than other means, even to the subject himself, his real meaning and intention — a fact too often overlooked, perhaps, in the laboratory of psychology.

The method of experimentation in detail was simply as follows: The hundred blot-cards being placed in order ten-square on the table before the seated subject and the norm in its frame conveniently before his eyes and above the blots, he proceeded to select within fifteen minutes the ten blot-cards out of the hundred most similar in form or shape to the norm, and to place them one side arranged carefully and deliberately in the order of their judged similarity to the norm. Meanwhile the subject reported how he apperceived the norm and what he considered its most essential form — characteristics and peculiarities. These subjective notes were recorded and the numbers of the ten blots judged most like the norm, and in their chosen order. The time required for a selection satisfactory to the subject was also recorded, and at the end of the selection the reason why each of the ten had been preferred, concisely as possible. The process in the case of

judgments as to unlikeness was precisely the same, with the appropriate change in intention to keep dissimilarity instead of similarity in mind. The subject was not allowed to turn any blot-card about or to observe the characters from more than one view-point, that, namely, directly in front, but no objection was made to orientation in imagination if the subject seemed impelled to so vary its meaning to himself. This was allowed for the sufficient reason that with characters so full of suggestive meaning as are many blots of ink it is impossible to prevent their adjustments in imagination without disturbing deeply the judging and selecting process. On this matter of position lay one of the interests of the experiments, for, in the complexity of psychic association, to turn a blot a few circular degrees is often to make it seem an entirely different object with quite different meaning for a particular percipient.

Altogether, about nine hundred judgments were recorded and explained, the details of these explanations from introspection on a basis of precise objective stimulus constituting an interesting study in themselves, which here we shall not touch upon. We shall be content to indicate the

general nature of the judgments as a whole and the principles of likeness and unlikeness which these judgments, so far as they go, empirically demonstrate in the range of the experiments.

The nature of the apparatus employed is obviously such that statistical results are for the most part of little use and photographic reports of the judgments made would have to be so numerous as to be impracticable. Careful and extended study and comparison of the sets of blots selected by the various subjects, however, brings out several striking facts as to the mental process concerned, the most interesting of which are as follows: —

The average size of these visual objects was such that ocular contour-movements probably were not much concerned in perceiving them. The projections, to be sure, tend after a while to be counted in an indefinite sort of way and their general shapes and directions noted. The blots are, however, too small to need outlining and are at once apprehended as units, just as are long words familiar to us. Be that as it may, the most conspicuous criterion of likeness and of unlikeness alike in these selections was what we may call relative massiveness. If the norm-blot happened

to be noted as massive or as attenuated or as a mixture of these two, selection was made accordingly. This appears continually in the results of the experiments. This difference was noted immediately in practically all the cases where animal associations did not occur, thus crowding it out. It implies, apparently, a fundamental criterion in comparison-judgments of form and gets its bodily basis in the relative number of retinal local signs bunched in the perception rather than in ocular contour-movements. This is apparently the most conspicuous of the sorts of "change of consciousness" which underlie our apprehension of likeness and unlikeness.

Another result of these judgments appears to be our excessive dependence on language-concepts for a clear awareness even of pure form. In almost every case the choices had their criteria of sameness or of difference sharply defined in words, expressed or not, of the subject. However pragmatic in their life-philosophy, all these subjects save one were obviously strong conceptualists. They made no progress in characterizing the norm-blot to themselves until words had arisen in their minds to make its character or characters definite and sharp. The sensa-

tional basis of the apperceiving process (a mass of retinal local signs plus a tendency to contour-movements) by itself led to no clear apperception of the blots. Whatever the confused experiences might be on perception of the blots, there was no clear notion of likeness or of unlikeness, no decided change in consciousness, until ideation had had its say. This would probably not be looked for in a set of subjects outside of college influence, where ideation is taught too often as the end-all and the be-all here. Indeed, the only subject who claimed to have a true *feeling* of likeness and of unlikeness was a student of music, naïve enough as a student of psychology. He too had the concepts associated with the respective blots, but he avowed a distinct feeling of similarity and of dissimilarity which persisted. It needs only a glance at the sets of blots chosen by him and compared with those of others to show that his choices were by far the most satisfactory of all the subjects' sets. The explanation is not afar off: Even these simple bluish-black forms in only two dimensions have so many characters that to specify one, or two, or three, and compare them by these leads to imperfect and misleading results. On the other hand, the "feel-

ing" of likeness or of unlikeness implies a much wider acquaintance with the blots and is, therefore, the basis of a better comparison. Related here is obviously an important educational principle which he who runs may read.

These experiments, again, illustrate the high stage which symbolism has reached in our social mental process. In nearly every case the subject found difficulty in inhibiting the reproductive imagination of animals, starting from the norm and extending to the blots chosen as like or unlike it. This process was interesting, but, being foreign to the topic in hand, was excluded because it led to comparisons obviously artificial. It was, however, often only with difficulty that most of the subjects could be induced to perceive the characters as mere chance-blots of ink, as masses of black color filling in an absolutely meaningless outline on a bit of white paper. If this inhibition were not insisted on (as at first it was not) the subject compared imagined animals rather than blots. One man, for example, promptly said the norm was a bird and thereupon chose ten "birds" flying, standing, roosting, swimming, swans and eagles, storks and humming-birds. However, it was not difficult for the subjects to overcome this

symbolic menagerie-habit, so to say, and to use other criteria then those suggested by the associative imagination.

The two preceding results from these simple experiments (namely, the highly conceptual, and highly symbolic, characters of the class of perceptions here concerned) lead to suggestions as to the subjectivity of likeness as a mental fact. One thinks of Bradley's surprising collection of "objects that do not exist" when one sees how various are the qualities ascribed to this set of objects. As a matter of fact, these differ, for the most part, only in mere outline, by which they may be arranged as like or as unlike. One tends *pro tanto* to lose faith in mere ideas raised in the idea-overburdened mind when out of a hundred blots compared with a norm one sees seventy-one chosen as "similar" to it. Three blots were chosen by each of seven subjects, one by six subjects, six by five subjects, seven by four subjects, ten by three, sixteen blots by two subjects, and twenty-six by only one subject — these numbers applying to one norm, but being of average sizes. When one laid out the sets chosen by the concept-criteria the differences in the blots often struck him more forcibly than did their sameness. Yet

each subject had all the time he wished for his selection and made a deliberate choice, as deliberate at least as real life would usually allow of his making in comparing actual experiences. Only very rarely, moreover, would the actual objective similarity in life be as narrowly confined as in the conditions of these simple experiments.

Within the number of those subjects who chose their similar and dissimilar blots by ideal (rather than by affective) criteria, there is a considerable range of formal accuracy, dependent on the ideas employed. Some ideal criteria were obviously more essential than others and led to the selection of a set of blots evidently like each other and the norm. Ideal criteria gave more accurate results in the dissimilarity choices than in the similarity choices. This is, as we should expect, on logical principles. The awareness of unlikeness is an easier, if not a simpler, process apparently than that of likeness, for the change of consciousness is greater and so easier to appreciate. At any rate, the sets of blots chosen as unlike the norm were much more certainly unlike it than were the "similar" blots chosen like it.

As we pass, it is not improper to note the indirect evidence afforded by these experimental

results of *the motivity and dynamism of even conceptual consciousness.* Ignoring the larger questions as to understanding, there is here ample illustration that such a cognitional process as the comparison of bi-dimensional forms does not ordinarily find issue until the actual *word* symbolic of a concept is fairly clear in consciousness. If it gives the subject the impression that it "appears" out of his vague subconsciousness (as often is the case) that is another problem that neęd have here no further mention. This conscious-becoming of an actual word can mean nothing else, it seems, than the innervation of those muscles and glands whose proper coördination would utter the word. Such dependence of an intellectual process as general as that of a judgment of likeness or of unlikeness upon the activity of the neuromuscular mechanism of speech is not any too frequently at hand. Here it can be taken for what it is worth in the doctrine of the relations of body and mind.

Were we to summarize and fuse the notions inductively suggested by this little research we could emphasize that judgments of bi-dimensional forms, when not geometric, are more accurately made by "feeling"-criteria than by

conceptual criteria. The subjects who paid most attention to the actual visual sensations (retinal and oculo-motor) as objectified in *looking at* the blots instead of *thinking about* them, made the best, that is, most similar and most dissimilar, selections. The former in choosing similar forms kept the change of consciousness at a minimum by their method, for they retained in mind a more or less true image of the norm. The latter, the conceptualists, on the contrary (but only after innervating for the word), replaced the original visual image with a more or less partial concept and repeated it in their choices, but more or less forgot meanwhile the shape of the norm. The practical application of this principle, familiar to psychologists, to affairs, for example in the taking and evaluation of evidence in legal trials, should not be further delayed, especially since rather numerous researches along various similar lines (that of Cattell, for example) have all pointed to the same really important fact that what we see or hear or feel is often determined as much from within as from without ourselves.

Another result of this work that may be mentioned is its emphasis on the practical value of affective impressions in comparison with

knowledge that is purely cognitional. It is outside of the experimental results somewhat, of course, but it may be strongly believed that this principle is continually acting often to our disadvantage, and especially in education, in our relations with our generally experienced environment, and with each other. As demonstrably here, the learning mind, through too little attention to this matter, is led frequently to errors that might be often avoided did it allow greater and more nearly natural freedom to the sensational and especially to the affective aspects of our mental process. In education we are undoubtedly apt to overdo ideation and to underdo the affective phases of the developing mind. Greater objective activity in the free realms of feeling and less reliance on the "apperception-mass" would surely lead the child to see things as they are rather than as a more or less formal and hereditary association of ideas compels him to think them.

The one other result that appears most noteworthy of those suggested by this work is its evidence for the neuromuscular dynamic "basis" of conceptualization — evidence coming, it is true, perhaps not less from within than from

without! These chance-characters as a rule have in them a minimum certainty of conceptual symbolism — that is, on the average, they are about as far away in shape from language-symbols as any forms that could be devised. None the less, as we have seen, they usually start some conceptual associations, more often, on the whole, than trains of imagination, and they start these associations, so to say, without a push, without giving them more than the needful minimum of bias in any one direction — they introduce the energy but do not guide its course. Under these circumstances the association-time and especially the wholly subconscious start is very long oftentimes. Often, as we have seen, the consciousness was to introspection a mere confused and scarcely conscious jumble of more or less unpleasant strains in and about the head, eventuating, however, sooner or later in a *word* clearly thought or even spoken aloud. In the usual form of word-association measurements, in the formerly so numerous researches on reaction-time, the symbol used as a stimulus was either a printed or a spoken language-symbol and therefore in the closest cerebral connection with the muscular innervations, etc., of language-expression as developed in the brain

when the individual learned to understand and speak and write. In these cases, on the other hand, the stimuli were no such familiar symbols, practically part of the language-expression mechanism, but were rather almost unrelated stimuli, abstract, so to say, rather than concrete. None the less, after a time the speech-innervations were suitably set going.

It is hard to believe that this difficulty of language-association under these circumstances is other than the difficulty of making "new" pathways, combinations, in the expression-neurones of the brain. This means, probably, each time a new struggle through unaccustomed innervations of speech-muscles. There is apparently no other neurologic basis for the confusion and the delay. These last were both experiences unpleasant to the subject and tended, therefore, to be eliminated by repetition and habit, if it were possible; yet they were neither eliminated nor much shortened, at least within the limits of these experiments. Neurologically this is interesting, this slow and unpleasant fumbling around of a sense-impression among the infinite possibilities of cortical (and nuclear?) routes. It is interesting, too, in a broader way, philological

and psychological, in so far as it suggests that, in the human mind as of old in the great empire, all roads, even the most unlikely trail of a chance ink-blot form, lead sooner or later into the (mostly muscular and epithelial) innervations of language-expression — the one function characteristic of humanity. As has already been suggested, these stimuli were as far as possible from language-symbols of any language, and the outcome of the association-process was, therefore, all the more striking and suggestive, however inferior the determination of likeness and unlikeness by this process as compared with the few cases where the cerebral association remained of the affective aspect.

Recent advancement in biochemistry and especially in neuro-metabolism has made possible suggestions more definite by far than ever before as the real nature in scientific terms of these innumerable influences darting through the cerebral maze that psychologically we discuss as subconscious associations. However interesting, however, such speculations may be, the broader questions as to the relationship of mental "energies" to the forces we know as chemic and electric must outweigh in interest the purely physiologic

problem. How can we designate for proximate scientific use the ultimate nature of the neurogram, the memory-trace, the endless and perhaps ineffaceable "vestigia" of ever unique experiences? And if we could and did "connote" them, should we not forthwith find it quite impossible to discriminate the energies we described from the thing we speak of as consciousness, with its sthenic and asthenic conditions, its dynamogeny, its varying qualities and quantities and durations, and the other numerous characters which it shares with the "somewhats" that even the avowed dualist (if he truly exists still) speaks of as energies? In fine, then, why do we not give up this two-faced terminology of a bygone time and speak the straight language that leads to clear thinking and to real knowledge in terms that are ultimate? To the writer it is unknown what proportion in general of the psychologically informed consider that ideation (as well as feeling and willing) is immediately inter-knit with ("dependent on") the innervation of the muscles and glands that would express the concerned ideas. One would almost assume that nearly all psychologists who know their physiology fairly well (they are none too numerous)

would nowadays thus presume the basis of thought, for gradually the psychophysiologic chasm is narrowing, or, at least, many firm bridges are being thrown across it; perhaps before we fully realize it we shall look in vain for the chasm itself!

However all this may be (the "physiology" of ideation and thought), here in this research is adequate evidence, so far as it goes, that an idea comes plainly "into the mind", that it becomes clearly conscious, *only with definite innervation and more or less deliberate and complete occurrence of the dynamic muscular movements that would express the concept in words.* One can dimly *feel* the similarity or dissimilarity between two chance shapes, but in most persons, too many, perhaps, the feeling is useless and even oppressive, until definitely expressible in neuromuscular terms more definite and distinct than those of a feeling-tone: that is, articulated.

And this "articulation" in its turn depends upon a phase of neuro-musculo-glandular *skill* just as in the opposite direction, speaking logically, thought depends on *comparisons*, that is, to say it once more, on determinations of likeness and of unlikeness.

Professor J. H. Bair, of Philadelphia, sets out the reasoning process, systematic thought, in a simple and untechnical way which relieves logic of some of its familiar awe and unnaturalness:[1] —

"It is true that, even logic, in order that it may develop the mind in an efficient manner, must be based on concrete data. The order of the development toward thought is: first the child has impressions. Soon it recognizes likenesses and differences. The faculty of perception, recognition and discrimination appears. The child begins to associate and classify the likenesses. Assimilation or apperception takes place. When it classifies the likenesses, *i.e.*, assorts them according to their characteristics, labeling is inevitable and thus the concept is formed.

"Every time the child puts an object in a class he passes judgment. 'This is a pencil.' He mentally assimilates this object with a class. Each class of objects has a boundary drawn around it, and in passing judgment the child decides whether the object belongs inside that boundary or not. Judgment involves, therefore, perception and discrimination. Judgment is unavoidably exercised where perception and discrimination take place, and discrimination and perception are impossible except with reference to the objective. In formal exercises of judgment, discrimination and perception are not exercised and this shows the futility of working beyond the bounds of concrete experience with children.

"Reasoning is but one step in advance of judgment and implies judgment and all that judgment implies.

[1] University of Colorado Investigations, III, 2, April, 1906.

And so if it can be shown that judgment formally trained is less fruitful than when developed incidentally in the ordinary processes of observation is it not equally true that training in observation is the best groundwork for reasoning?

"If we take the following illustration of reasoning: 'All men are mortal. John is a man. Therefore John is mortal.' Is not the whole process a case of refined observation? This can be illustrated by circles. Mortal beings have a large boundary, within which are a great many groups having smaller boundaries. One of these groups is man. Now if John falls within the circle of mankind, which fact is ascertained by judgment through comparison then he must also fall within the larger circle mortal beings. The point I wish to make in this analysis is that teachers should make it their primary object first, to stock the mind with facts to develop the power of observation and discrimination which are fundamentally involved in all higher forms of thought and secondly, where the higher faculties are exercised, to confine their activity within the realm of the stock of facts in the mind. If this point is complied with in primary education it is certain that the results will be satisfactory. . . .

"The fundamental reason why children fail in their power to construct is not because the logical faculty is immature. But it is a fact of development that the logical processes do not function efficiently until the mind has a stock of information which constitutes the material upon which the logical faculty can work. The savage, or ignorant person, as well as the child ofttimes arrive at conclusions which are invalid because their concepts are indefinite and their stock of information

limited. The primitive man, when he hears wind whistling through the boughs of a tree, thinks there is a man or a spirit up there making the sound. This conclusion he reaches because of his notion that sound is always produced by animate beings. To modify and to improve his reasoning his information must be exact and his ideas changed.

"The fact that in the Middle Ages arguments were advanced and conclusions supported which are no more tenable is no evidence that in these days the reasoning power is more subtly developed. Quite to the contrary the thinking powers of modern scholars are probably less exercised and developed than those of those early thinkers. What makes present day thinking more efficient is the fact that for several generations the students have devoted themselves to observing and collecting facts, not to getting acquainted with nature. A century ago the whole spirit of science was to gather facts from nature first hand. Earlier thinkers had many arbitrary notions and preformed ideas about things. When the ideas upon which a conclusion is based are not right no amount of intellectual legerdemain will make the conclusion right.

"To lay the foundation for sound thinking the power of observation and discrimination must be constantly exercised and developed. Childhood is for training the senses. Its principal school exercises should be observing, examining, handling, comparing and reproducing. The foundation for the intellect is laid in this manner."

This or something similar assuredly is the essence of thought. It is the most productive

of processes because *it alone of all mental processes produces something new and rational.* Ingenuity, originality, invention, and discovery in part rest often wholly on this simple (?) process of inferring something from the results obtained by comparing two things. If love "makes the world go round", thought makes it go around its orbit, makes it revolve and so advance. If love makes the days worth while, thought, as well as love, helps so to make the years.

Let us not forget the educationally important matter of the *complexes* of thought and imagination and feeling already discussed in the treatment on the imagination. The mind works as much in thinking as it does in feeling, or in willing on the symbolic plan. Morton Prince, in his enlightening "The Unconscious", has summarized certain of the conditions of complex- or symbol-formation, memorizing, and recall, in a way well worth quotation: —

"Though the main teleological function of the unconscious, so far as it represents acquired dispositions, is to provide the material for conscious memory and *conscious* processes, in order that the organism may be consciously guided in its reactions by experience, yet under certain conditions neurographic residua ["brain-traces"] can function as a *subconscious* process which

may be unconscious, *i.e.*, without being accompanied by conscious equivalents. The latter were classed as a sub-order of subconscious processes. We saw reason for believing that any neurogram deposited by life's experience can, given certain other factors, thus function subsconsciously, either autonomously or as a factor in a larger mechanism embracing both conscious and unconscious elements; and that this was peculiarly the case when the neurogram was organized with an emotional disposition or instinct. The impulsive force of the latter gives energy to the former and enables it to be an active factor in determining behaviour. The organism may then be subconsciously governed in its reactions to the environment. . . .

"We found evidence showing that a conserved idea may undergo subconscious incubation and elaboration, and that subconscious processes may acquire a marked degree of autonomy, may determine or inhibit conscious processes of thought, solve problems, enter into conflicts, and in various modes produce all sorts of psychological phenomena, (hallucinations, impulsive phenomena, aboulia, amnesia, dissociation of personality, etc.) . . .

"Evidence has been adduced to show that life's experiences, and therefore acquired dispositions, tend to become organized into groups. The latter, termed for descriptive purposes neurograms, thereby acquire a functional unity; and they may become compounded into larger functioning groups, or complexes, and still larger systems of neurograms. Whether their origin is remembered or not they become a part of the personality. Such complexes and systems play an important part by determining mental and bodily behavior.

Amongst other things they tend to determine the points of view, the attitudes of mind, the individual and social conscience, judgments, and the like, and, as large systems, may become 'sides to one's character.'"

This is the very latest scientific word on thought and ideas as they persist in the mind, but for the most part just outside of the conscious process, immersed deep in that truly "Wundtian myth", the stream of mind. This store of ideas, of thoughts, unlike most other stores, loses nothing by being drawn upon. On the other hand, it can be added to indefinitely without any crowding, for the useless material is continually being put into the scrap-pile — forgotten.

In discussing learning to think, there are six practical points to be noted: (1) a realization of the necessity and the joy of thought to education and to success; (2) development of interests as various as possible, provided they be not too diverse and too numerous at the same time; (3) an abundance of clear ideas ("concepts"), especially of relationship; (4) a habit of concentrated attention along more or less "rational" or logical lines; (5) a thought-habit developed by practice (writing, debating, reflection), and (6) the opportunity for thought, (time and relative solitude).

The realization of the necessity and the delight of thought. The average boy and girl has no way of learning that what counts most is this thought, this initiative, this imagination. Experience alone (sometimes precept!) will prove this to him. But observe the advertisements of the efficiency schools! Without a doubt experience shows overwhelmingly that just this chiefly makes the difference between a narrow life of wages and the broader life supplied by a salary. Everyone has more or less information, but only a few use it in thought and so do things which are new, or do old things in new ways — which is the next best accomplishment.

Development of interests. In a previous chapter the absolute necessity of interest for learning has been pointed out. The necessity is still surer for thought, for true wisdom, for real education. If we develop interest in any subject, the subconscious will think it out by association, by the aid of the imagination, if given a chance, while we are doing something else. This involves, as we have seen repeatedly, an affect or feeling-tone to furnish the motive power.

An abundance of clear ideas, especially ideas of relationship. The relation of language is im-

mediate here, as has been pointed out recently by Dr. A. A. Berle, in the second chapter of his interesting "Teaching in the Home", already quoted in the discussion of books and their educative use. Harvard College has recently made an extensive investigation tending to develop the study of English along this basal line of intimate relationship to our primal and dominant intelligence. Ideas of relation are especially essential; by their very nature they tend actively to associate educatively, and their elaboration should be a systematic part of all school work. The habit of the use of thesauri (dictionaries of synonyms and antonyms) is easily acquired, and there is an amazing interest in the relations of verbs, nouns, adjectives, and adverbs — things, their qualities, what they do, and how. Knowledge about these very relations is essential. Especially important, then, are these books of synonyms and antonyms. When the habit of using them has been acquired, they do much to develop thought, as well as clearness of expression and literary style; they help the mind to work logically and systematically.

For emphasis it is worth while repeating that words are dynamic and make up language and,

moreover, they serve to connect it with the brain and thereby with the remainder of the body and the rest of the individual's kinetic world. Words, then, are the indispensable handles of our human thinking, symbols of our energy-expense, and so of our humanity itself. The closeness and the depth of this dynamic relation are worth strong emphasis, for its general educative importance is supreme.

Professor Max Müller was undoubtedly the farthest- and deepest-seeing of all who have searched the depths of human speech. It is to his writings the reader may best turn who wishes a knowledge of the philosophy of words. "We arrive in the end", says he, "at roots, and every one of these expresses a general, not an individual, idea. Every name, if we analyze it, contains a predicate by which the object to which the name applies was known." ("Science of Language", London, 1861, Vol. I, Page 356.) Language-root; general idea; predicate; bodily action relating the personality to its kinetic environment, thus becomes the logical series of ideas linking speech, skill, and intelligence. Language is the dynamic index of a world of energy in relation to ourselves, and the kinesthetic sensations are the more

immediate personal and mental index of this dynamic relationship.

Here once more, and more explicitly still, perhaps, the reader may see for himself the necessity of what we have termed "skill" (complete bodily control) for clear thinking. Here obviously is the basis, or part of it, of the undoubted heredity of talent "mental" as well as "bodily." Normal living fosters skill because right-living means good health, plenty of sleep, abundant nourishing food; and the generations hand down its results. And skill, in our sense, for the reasons suggested just above, fosters language; and therefore thought; and therefore intelligence; and therefore, generally, real success; and therefore, finally, *happiness.* This concatenation, this chain of life, is as certain as the great sun's energy in our muscles, and physical education will one day learn to make it clear and certain to everyone.

The habit of concentrated attention is necessary in thought. This concentration should be for short periods along lines not disagreeable to the human rationality. Concentration sinks ideas more deeply into the brain — how we do not know as yet and cannot imagine. Attention, either reflex or voluntary, however exactly it

may act, is certainly essential, but save in cases of exceptional individual interest, such as that in discoveries, emergencies, inventions, and the like, attention can be concentrated properly for only short periods of time. Professor W. H. Pyle, of the University of Missouri, as a result of experiments on practice work, in using a devised set of characters instead of the ordinary letters, found that the adult's ideal period for concentrated effort of attention is only thirty minutes. He says: [1] —

"The object of this investigation was to determine the proper length of period and the proper distribution of periods in drill or habit-formation. The experiments were begun in February, 1910, and have been continued to the present time; the subjects — at all times as many as eight or ten — were mostly seniors in the University of Missouri, and the practice has been in typewriting, shorthand, memory work and in learning to write in arbitrary characters instead of with the ordinary alphabet. The method was to give the subjects practice for a certain length of time, requiring all to use the same procedure, then the subjects were divided into two groups. One group was then given practice using the same procedure as before, while the other group used the method then being tested. The first or control served to give a measure of ability of the

[1] Paper before the American Psychological Association in Cleveland, 1913.

subjects when using the same method. After this method was perfected, the only material used was the arbitrary alphabets which seemed best to serve the purposes of the experiment.

"The results, in brief, are as follows: On the whole, 30 minutes seems to be the best length of practice period. In some cases, shorter periods seem a trifle more advantageous, especially in the early stage of practice or habituation. But, generally speaking, one gets ample returns in habituation for practicing up to the point of fatigue, which, in our experiments proves to be 30 or 40 minutes for most subjects. Eighty minutes, the longest period used, proved decidedly disadvantageous, especially in the early stage of habituation. Generally speaking, daily practice seems to give better returns than the same number of periods distributed on alternate days or in twice-a-day periods. However, there is some evidence that in the early stage of habituation, the second practice on the same day gives good returns and that, later on, alternate days may be the best distribution. While practicing twice a day does not give, on the average, as good returns as once a day, if we count the same number of periods, it gives much better returns if we count the number of days, the subjects, of course, having twice as much practice as those working once a day. That is to say, if one does not count the time, it pays to practice twice a day, at least till we gain considerable efficiency."

Professor Daniel Starch of the University of Wisconsin, in 1910, studied the comparative economy of different periods of work, and he summarizes his findings thus:—

"The purpose of this experiment was to determine the relation of the length and distribution of periods of work to economy in learning. The learning consisted in associating numbers with letters. These associations were formed while transcribing prose into numbers.

"One group of persons worked 10 minutes at a time twice a day for six days. The second group worked 20 minutes at a time once a day for six days. The third group worked 40 minutes at a time every other day for six days.

"The records show that the 10-minute group improved more rapidly than the 20-minute group and the latter improved much more rapidly than the 40-minute group. The 20-minute group transcribed on the average 31 more letters in every five minutes than the 40-minute group and the 10-minute group transcribed on the average ten more letters in every five minutes than the 20-minute group."

Thus we see that ideas "stick" best when they are impressed in periods of only thirty minutes or less, two or three times a day. We may use this as a rule for thinking — it means *the importance of keeping the brain always rested.* This is far more essential than the saving of mere time. Muscles, especially in gross masses, may be fatigued without nervous harm, (in fact this kind of fatigue makes for sound, restful sleep) but never the nerves. There are nine thousand million neurons or nerve-units, weighing only a

few grams altogether, in the human cortex: from this may be seen how minute and subtly delicate they are. We should not fail to appreciate this fear of their easy liability to fatigue, for it is a very real educational matter. At the same time the brain may be *trained* so we need not coddle it. Most people undoubtedly do coddle their brains, but usually from human laziness, not because deeply wise in hygiene!

Habituation to the thinking process. Habit makes thinking much easier than it is at first. Habituation makes thought a continuous subconscious process. Just as we know that worry is worse for the health than an occasional fright; and just as a steady drinker suffers more pathologic harm than the man who goes off on an occasional drunken spree; so, on the other hand, the continuous use of thought most impresses the brain. The habit of learning-interest must be acquired; but this mental attitude soon becomes more or less permanent. Habituations of all kinds, of course, are more or less accumulative. It is "the first step that counts" we have often heard, and all habit grows with what it feeds upon. Thought is a habit, subconscious like all of them. In order to acquire the thinking-

habit, other habits may have to be bent [1] or even, sometimes, broken. (a) The general principle is that in proportion to the stability of the nervous system of the individual, according to age, sex, or vigor, may a habit be suddenly bent down out of existence. (b) A second process of displacing a habit is busy normality. And a third, (c) is replacement with some other more useful habit. In general, students who are apt to read these pages can break short off whatever habits conflict with the thinking or the study habit.

A sixth and last element in easy thinking is *opportunity for thought, in time and in relative solitude.* Many of us are "too busy" (but with far less productive things) really to live or really to think. *We should make time, make solitude, for thought.* People are often much too continuously together, especially young people. Each individual is separate, and occasionally requires individual separate self-communion. Most of us should room alone, or else manage in some way to spend considerable time alone in the forest, along the seashore or brookside, or even

[1] See for a recent discussion of habit-bending G. V. N. Dearborn: "Habit and Malocclusion", *Medical Record*, New York, 88, 18, 3 Oct. 1915, 727–732; and "An Ideal Gift for Your Children", *American Physical Education Review*, XXI, 7, 1916.

in our own rooms. The gentle exercise of a stroll or of a slow bicycle ride which requires little attention for itself is an ideal stimulant and occasion for thinking — unless the attention wanders outwardly too much. The time to be alone now and then should be had somehow. Oftentimes schools are too crowded to allow their students to think. We can properly afford, even as a matter of dollars and cents, to take an extra year in school, if by doing so we can learn to think; the time so used is a rich and certain investment, not an expense. In default of a better time, a half hour after waking and before rising is a good time in which to think. Indeed, many people have their most productive and original thoughts occur to them at just this time in the morning, early, after a good night's brain rest, for the unconscious grist of the night then tends to become conscious. The nervous system will generally be found thoughtful if an opportunity be given it.

This advice *to make thought-time at any cost* is well considered, not an idle notion. It is wholly practicable and expedient. In fact, it is very often a matter of dollars and cents and of advancement, and not one only of developing our

soul and personality, which much of the world has not yet learned to value at its worth. Robert Browning's familiar three stanzas express this so well that we repeat them here. They are from "Rabbi Ben Ezra", a poem of efficiency, of human life, as well as of God: —

"Not on the vulgar mass
Called 'work' must sentence pass,
Things done that took the eye and had the price;
O'er which, from level stand,
The low world laid its hand,
Found straightway to its mind, could value in a trice:

But all the world's coarse thumb
And fingers failed to plumb,
So passed in making up the main account;
All instincts immature,
All purposes unsure,
That weighed not as his work, yet swelled the man's amount:

Thoughts hardly to be packed
Into a narrow act,
Fancies that broke through language and escaped;
All I could never be,
All, men ignored in me,
This, I was worth to God, whose wheel the pitcher shaped."

Thought, like almost nothing else in the whole world, makes for *both* of these, for human personality, and for success as measured by dollars and cents.

Rules for thinking are wholly unnecessary even to a young student. The normal human mind, always knows how, as part of its normality. Possibly no other animal knows how, but man knows how, and so do all normal boys and girls. The only explicit rule for thinking is, it seems, *Acquire the habit!* In plain language it is laziness, that more than anything else prevents this habit of thought, for with all its interest and delight to learn to think, to become a thinker, is not always easy in this resistless world which never stops its hurry. Some really do not know how to think, but only, we may be certain, because they have never tried to learn. The vast majority are just simply too lazy to put their thinkers in order and to use them. And this is so, curiously enough, notwithstanding that constructive mental action is a great *delight* as well as by far the most practically productive process of the mind. A few of my readers may here be "thinking" or even saying in annoyance, "I did not buy this book to be accused of laziness." No indeed, you did not, but some of you did buy it to learn how to learn easily, and one of the most essential things to be learned for this purpose is the utter incompatibility of learning and indolence. Were

it otherwise, learning would be of relatively little financial use, for every common millionaire would be a thinker, and each whilom tramp a millionaire.

He who really *thinks* can never become conceited over his supposed learning. We may adopt the traditional colored preacher's attempt to make massive the idea of infinity despite the simile's inconsistencies on close examination: imagine a small bird hopping to and fro from Boston to San Francisco, carrying at each westward trip a mouthful of water from the Atlantic into the Pacific Ocean: when the Atlantic at last was empty — this was this man's suggestion of an infinitely future time. But so is human thought in comparison with the eternal miracle of Reality. Its eternal interest is a vast delight, and the interest "grows with what it feeds upon." Our thought and imagination grow best when the mind is fresh, for then the neurons are stimulated and actuated by the desire for activity. Sleep and play are as essential for thinking as for other biologic things. In thought, more than in any other mode of action, the mind makes profit out of sudden gleams of light, out of inspirations; and play often stimulates

the imagination and leads to the development of something new in thought.

The time of day in relation to the quality and the quantity of the work accomplished in thinking has much practical importance in the long run, and despite widely-varying personal habits of work and sleep and play the scientific status of the matter has worth while practical interest. Professor W. H. Heck, of the University of Virginia, has studied the matter by grading the arithmetical reasoning of 255 girls and 212 boys (average age 14.2 years) in a grammar school. "The number of examples done in the afternoon was 0.68 per cent greater than in the morning; the per cent of examples right in the afternoon was 3.22 per cent. less than in the morning." This result has been corroborated by like work done at Lynchburg and in New York. Thus we see that while the speed of such thinking in the afternoon is practically that of the forenoon, the accuracy is distinctly less. I have the impression derived both from personal experience and from sundry researches, that the most productive hours in the whole twenty-four, qualitatively and quantitatively together, are the hours from 10:30 A.M. to 12:30 P.M. *Then certainly the*

quality is at its highest, and this is particularly true of creative work — thought in its broadest sense.

For the integration of our thinking in a broad way and for making our opinions and ideas at once more coherent, more intensive, and more conscious, no method exceeds in usefulness that of *writing definite articles or essays*, each with some topic-title not too narrow. Obviously for learning purposes this is the often-hated "composition" of our early school-life — hated oftentimes just because its writing involved the completion of a certain definite amount of *real mental activity in a definite time.* This is a kind of debt to our education which may not be, like "Micawber's" note-debts, paid always with other notes, other promises to do. Writing, as Francis Bacon reminds us, "maketh an exact man," but writing, too, makes a boy or girl, as well as a man, not only consciously aware of what is known and thought in his more or less hidden mind, but makes that more precise and its relations round about more real. And also more numerous. In other words, *writing much on set topics not too narrow, clarifies and extends our ideas and makes them also more dynamic.* Nothing else, unless it be active oral debate, can do this either so economically or so well.

CHAPTER VI

EXAMINATION-PREPAREDNESS

All kinds of instructors who hold examinations frequently suggest that the direfully dreaded "exams" will take care of themselves if systematic work be done vigorously and conscientiously throughout the course. This statement may be cordially emphasized, although, however true and important it may be, there is little hope of making students, male or female, young or old, married or single, civil service or naval, in the elementary school or in the university, indolents or "greasy grinds", believe it long enough to act upon it to any appreciably profitable extent. They never have done so (save one or two wise ones here and there) and they probably never will! Nevertheless the fact holds that if we do study properly and conscientiously and scientifically, *the examinations will take care of themselves.* There are a number of reasons why the matter is important, but one that is very important

concerns the effect of worry on the mind. But work counts too. On the marking system of E upward to A, if we take our ease we shall get E's and not A's. Ease and E's go together.

The chief requirements of proper study for this specific purpose of "making good" on exams. may be divided into three parts. (1) *The entire necessity for conscientious, thoughtful study; for an adequate amount of real study with the attention complete.* It seems surprising that students do not effectively take for granted this matter of plain common sense. (2) The *keeping of our notes posted up daily in the brain,* and thus everything we learn integrated with the preceding acquirements. If we have taken no notes, we should begin to make some from our lectures and our textbooks, and from our memory, for these will certainly be better than anything else for this examination purpose. (3) To get a good examination mark, *we should have somehow a weekly or at least a monthly review,* because, as we have seen already, review is the chief means to the integration of any subject in our minds. *Notes should be kept on the analytic plan* of complexes or symbols which have been already explained, headings, subheadings, and so on, on rational systematic lines.

Such subconscious preparation is theoretically the best and proper way. Examinations are *incidents, and not ends,* and they are a necessary evil to every instructor, even more than to every student. If study for examination is done along these lines, in this general manner, learning is really learning. In addition there is no worry. No worry-excitement arises in the mind, as the "critical" time approaches, no phobia to disturb and even undermine the mental and bodily processes, and to disarrange the ready association of ideas. There is a vast waste of energy in worry; fear (worry is fear) starves the brain by using up on itself its food over-fast.

On the other hand, the prospect and the certainty of an examination provide the requisite emotional tone to give study its necessary concreteness and practicality. Examination is thus an incentive to vigorous study and therefore more or less necessary educatively as well as merely expedient. If these "ordeals" had not been shown to be necessary by centuries of world-wide experience, it is absolutely certain they would have been abandoned, for they constitute to the conscientious teacher and instructor the most disagreeable and laborious portion of the entire

educative work. But at present examinations are undoubtedly a necessary factor in the process of real learning. Nothing can take their important part, nothing, at least, that is now over the pedagogic horizon.

Theoretically, examinations should be always at unannounced times, thus training the student in continual preparedness and insuring a degree of attention to the daily work which can be obtained in scarcely any other way. This expectation develops the important subconscious habit of "attending to business." It trains, too, in the power of suddenly turning our attention and then of using it to its utmost, mental dynamogeny. This, as President A. Lawrence Lowell of Harvard University points out, is required frequently in real life, — this power of clearly and vigorously turning our mind to any required topic on demand at an unexpected moment; many occupations depend on such ability.

Oral Examinations. Oral examination is the ideal form of them all. It is generally far more efficient as a means of testing our ignorance or knowledge of a subject than is a written examination. The universal objection to the oral examination is that it requires too much of the

examiner's time, far too much of the time of some costly expert. It requires less on the part of the student than does the written examination, but greatly more on that of the instructor. Any one, however, who has taken a university doctorate examination, in the focus of a concave mirror of kind but searching inquisitors, appreciates that it is the method above all others for finding out how little a student knows about a difficult subject. For this reason oral examination is coming more and more into use. Here it is possible to ask fifty questions instead of five or ten. The examiner can almost see the associational machine *work*, and therefore can judge for himself whether it be adequate or not; he sees the living mechanism itself, and not only its product. Theoretically, there should be more and more oral examinations in all kinds of schools, in the higher grade-schools, for example, as soon as it may be arranged; this matter is making progress, especially in the medical schools.

Written examinations are a make-shift, but they are much better than nothing. Oral examinations are far more psychological than written ones, and give the really efficient mind and knowledge a much better chance. About as many, I take it,

are handicapped mentally by the inability to write explicitly as are disparaged by the inability to talk quickly, briefly, and intelligently. So far as the student's welfare is concerned, there is no good reason to suppose that oral examinations would be a handicap. On the contrary, in the long run, the widely demanded training in self-possession, in repartee, wit, quick reply, would be of much use to almost everyone. This, too, is at heart a matter of adequate physical training, as "skill", already sufficiently discussed. Oral examinations require self-poise above all else save *real knowledge*. Both require a reasonable expression-intelligence.

Practical Examinations such as are given in physiology, physics, chemistry, and similar subjects are the ideal examinations. Their universal unpopularity shows well enough their value and their difficulty. They are the only kind of examination that show our real and practical efficiency. They make a test of what we can *do*, actually perform, rather than what we have merely learned about, second hand. Undoubtedly they are overdone in some professional schools. The proper place in general for the practical examination is in the normal school, for there

teachers are trained, and they must know how things actually should be done.

Writing Examinations. In written examinations, at least, *knowledge as to the range and kind of questions* asked in previous examinations is a right and not a privilege. The possible scope and methods are very numerous, and the student, therefore, necessarily has a right to "get the range" of the examiner, and of the subject as he presents it. If the previous examination-papers are on display, it is certainly the psychological duty of each student to get access to them in some way or other; no competent examiner will refuse this, although it will make the thoughtful work of preparing his examinations more arduous.

The *personality*, too, of the examiner is worth a bit of careful study. Strange as it may seem to young pupils, the usual instructor has fads and habits much like other folks. Here is where general, human, natural intelligence comes to the aid of the students. In certain cases, a knowledge of the examiner is only less important than knowledge of the subject of the examination. This is a personal, confidential point which should not be published widely, for some non-human logicians do not yet understand the need for a

knowledge of the motivity of human behaviour and possibly might deny their humanity.

Plenty of sleep for a week or more before an examination is well worth whatever time it costs. Every hour so spent is worth at least treble what you might expect unless you understand the efficiency-advantage of rested brain-units over those that are fatigued. Sleep clears the cobwebs out of the brain and memory, so that the nine billions or so of neurons can work in association far better than when they are fatigued.

General invigoration of the entire organism greatly improves the memory and the reasoning powers. Therefore much outdoor exercise is especially highly expedient during the few weeks before examination-time. In this way we tone up the whole organism and put it, as the athletes say, "on edge." At examination time it is desirable that the digestive tract be in good working order. Thus we may avoid that feeling of toxemic headache and general malaise which is incompatible with clear thinking and with accurate work.

A *light* breakfast or a *light* lunch of easily digested food is necessary before an examination, on the physiological principle that the blood, which

is limited in quantity, cannot be both in the brain and in the stomach at the same time. On the other hand, a hungry person cannot think readily, (nor can a cold person). This light meal, a short time before an examination, might very well include a cup of coffee or tea, not too strong, provided the student is accustomed to its use. This is obviously not a good time to try experiments as to the personal reaction towards drugs of any kind. Alcohol is harmful to all mental (and bodily) effort.

A student sometimes gains much *by looking over the entire material* of the examination *immediately before the examination-hour.* A large amount should be surveyed in a short time, — ten minutes or so on the whole subject matter, — not by any means a long time enough to tire the reader. In practice this is often extremely productive in suggesting partly forgotten facts and principles which (as experience shows) are just those required a short time later.

If the examination is to be written, prepare at least two fountain pens, well filled and clean. Or sharpen four or five pencils which are neither too hard nor too soft. Or have both. If the pencils are too hard, the examiner is apt to be reduced

to mild pedagogic anger when he reads the "book"; whereas if they are too soft, it is difficult to make a neat paper. This matter of writing-materials is far more important than the average student is apt to consider, so if "marks" be of any object (and sometimes they appear so to the examinee!) we might follow to good advantage the habit of the newspaper-men who use a large number of soft pencils and write large and legible script. Did students in general take these matters into consideration fewer examiners would sympathize with Ralph Waldo Emerson when he says in his "Journal": "What a pity that we cannot curse and swear in good society. My page about consistency would be better written thus: 'Damn Consistency'" — which is good psychology for several reasons.

So much for a few practical points as to *preparing* for an examination!

The next search is as to the scientific manner of actually *doing* the examination. Our mental attitude as we actually approach this concrete problem is of the utmost importance. We should set about an important examination with a grim determination to "eat it up" bodily, as the students say. This is what we mean by dyna-

mogeny, which has been already referred to in previous pages. This appears psychologically in the form of a conscious determination, a powerful determination reinforced by a strong self-suggested feeling of encouragement; it is *auto-suggestion plus an emotional tone.* Since the work in Cannon's laboratory, we realize that this dynamogeny depends in part on the increased amount, however, minute, of adrenin in the blood, but especially, perhaps, an increased supply of sugar there. This "dynamogeny" is a matter of great and practical importance, and no longer the perfect mystery that it used to be. This is an extremely important power, and for the writing of an examination or the doing otherwise of an examination, it may mean all the difference in the world, even all the contrast between failure and success. In the same way the man who is shaken into pneumonia with a firm determination that it shall not kill him, enjoys a far better chance that it really will not kill him than does one who is over-frightened by the prospect of undergoing this sad and irresponsible disease. There is a force in this human organism of ours which it would be difficult sometimes to stay in bounds, and this force can be used in the successful per-

formance of examinations as well as elsewhere. Reduced to scientific terms, it means the more or less controllable force of the influence of the mind over the body to which there is at present no assignable limit.

As we enter an examination-room, if there be any choice, we should choose a good light without having to face the unprotected brightness of the open sunny sky, which would in varying degree irritate the brain. We should choose a place where there is ample rest for the elbows, for combined all of these minor subconscious strains on the central nervous system *count* in a long and fatiguing examination and help to weary and retard the action of the brain. We should choose a *cool* rather than a warm place in the room. We should insist that the room should be adequately and amply *ventilated*, because it is better that it should be open to the air than too restricted. The ideal approximates to good outdoor conditions of breeze and dampness. The best temperature is 65° Fahrenheit, for the excitement and the attention of the work is sure to raise the personal temperature somewhat and this, in combination with a too warm atmosphere, would produce a flow of sweat which would be

uncomfortable and so distract thoughtful attention. On the other hand a chilly person cannot think readily.

As in all other forms of long mental strain, the wise student frequently will rest his eyes and the muscles of his head and neck by looking around the room. This changes (lengthens) the focus of the eyes and thereby rests all parts of this extremely delicate seeing-mechanism. At least once in every fifteen minutes a minute or two is used with the greatest economy in looking around.

It is almost impracticable to say much about *penmanship*. The matter is undoubtedly an important one from the student's point of view, and not less so certainly than from the examiner's. The obvious fact is that plain writing in the long run of emotional examiners distinctly tends toward high marks. The writing must not be too fine or faint, such as that made with a very hard drawing-pencil; and it must not be too difficult to read because of poor handwriting. Relative illegibility puts the examiner in bad humor and that is a bad "policy" for the examinee. It is worth while to put plainly on the examination-question papers given to the students that "the

answers should be concise and systematic, and the writing must be plain."

It is inexpedient to enlarge here upon the necessity of *good English*, yet there is, none the less, a widespread tendency in schools of all grades in the United States to use the English of all written examinations, if not those that are oral, as a test of the *general intelligence*. This is one of the important things for the advancement of general intelligence. The reading and the grading of examinations is positively the worst of all school-work, especially where the school is large. One instructor I know reads more than thirteen hundred "exam-books" in a college year! Under these conditions we should expect that the feelings of the average examiner would be unable to stand much further strain and remain free from uncontrollable resentment. Therefore write good legible English, on the general principle, if on no other basis.

Do not think that an examiner is going to take anything "for granted"; theoretically he should not and in practice he may not. Details, then and explicitness (facts) are wholly necessary for the securing of high marks. It is statements, *true statements*, showing knowledge and under-

standing, that count; the more of them, the more credit-marks a student receives. But observe that not all words are statements! far from it. Using the slang because of its explicitness, all "hot air" should be left out of an examination. It wastes the good humor of the examiner, which is a very costly kind of waste under the circumstances. It is *ideas* in general, not words, that count: in fact, words that do not express any ideas are rather worse than nothing, because they waste the time and precious patience of the examiner. It is obvious that in many respects the examination is a test between the student and his examiner.

Pictures and diagrams, especially when labelled and explained by text, are an ideal way of partly writing an examination, and oftentimes students deficient in the power of good English or of good handwriting, can remember pictures and sketch and label them when they cannot describe explicitly the conditions. This in itself is an important power of education, this faculty of remembering, of understanding, and of reproducing pictures and diagrams, and here of great and granted use.

In long examinations where the hours are apt

to be crowded, as in many professional examinations, the examiner should not object to the syllabus style. Schematic arrangement is of the utmost importance in writing a paper which is to be high-marked. We have called attention to this matter already — sub-divisions under properly logical headings. We may be sure that an examiner will always appreciate this arrangement, for it relieves him of needless work and shows, at the same time, that the student really understands, in a psychological way, the material which he has offered. *Conciseness* is important, but conciseness is not necessarily brevity; it means brevity only so far as consistent with fullness and clearness — the omission of unnecessary words.

Good humor is important, as in other situations in life, in this writing of examinations, and still more in an oral examination. Here the native intelligence of many individuals shows itself to the best advantage, as they realize, for dons and professors, and even state boards of registration, are human after all, little as some students suspect it. *All our wits and a bit of wit!* might be our motto. But not too much humor, and not too much wit, for some examiners think it undignified

to smile, and so discount the work of the humorous student. Flattery and titles are absolutely fatal in an examination, for the average examiner will not stand them. In general, confidential notes appealing to some person who is interested or to personal relations of the examiner are not highly productive of scholastic success — nor are graphic pictures on the last page (such as have been seen) showing a weeping female on her knees begging for A's (or at least for a D).

We should plan out the entire time allotted for the examination, allowing so many minutes for each question with an ample time for review — at the end. It is a good plan, having done this, to remember the limit of time to be devoted to each question and, if necessary, return afterwards to an unfinished answer. On the other hand, provided the question can be satisfactorily answered or answered as fully as is possible, we should go immediately to the next question.

It is an extremely common *error*, and one highly harmful to the average student, *to hurry through an examination* and not really think, or at least succeed in recalling, what he really knows. Examinations test intelligence and this hurry shows that there is none of it present. There is no excuse

for this, save in highly professional examinations in which the examinee is given just time enough to write rapidly what he should, with scarcely a moment at all for search-thinking or for recall. An examination ordinarily should give some time for thought on each question, and it is highly important that this time should be so used.

It is a common error, also, to think well and hard at first, to push the mind well in the early part of the examination, but to stop the effort when a little tired, although the examination be only partly completed, the latter half, even, being slighted. *Examinations test the entire intelligence,* or they should do so, and one is not intelligent or a proper student whose mind is so little trained or so weak as to make this mistake. The old trick of writing one-half, or as much as may be, of the paper and then saying the "time is up" or "no time to finish," of course deceives no one. The last question is just as important as the first one, and it is the student's *business* to be sure that it be answered as well as the first, if he be looking for good marks. *Bluffing* is dead fatal to success in the long run, even if it does hit the pass-mark now and then. This occurs as a pretense of having knowledge which we know perfectly well we have

not, trusting that the hurried examiner will mistake mere words for the statements required. We might expect that the feminine mind would be more successful in this than the masculine. We should not confuse this with intuition, which is appreciated subconscious knowledge. Oftentimes there is more in our subconscious mind than we realize and only by the actual expressive motor reaction of trying to write it do the associations which occur in the mind show themselves in consciousness.

We should not judge an examiner's mind by our own. It is generally true and germane, explicit, ideas that count, and not our particular notions of these essential ideas.

Examinations require above all things else (*save learning*) *self-possession* for a highly successful outcome. Adequate physical training, systematic and continuous, will help us to this self-possession like nothing else save actual practice in this highly human educational art. To avoid examinations is to cheat our learning mind; to flunk them, to cheat ourselves.

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